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A THIRD JOURNEY OF EXPLORATION IN CENTRAL ASIA, 1913–16.

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ABUNDANT as were the results brought back from the journey which during the years 1906–08 had carried me through the whole length of Eastern Turkestan and portions of westernmost China and Tibet, they could not keep my eyes long from turning towards plans of another Central-Asian expedition. It was not the mere "call of the desert"—strongly as I have felt it at times—but the combined fascination of geographical problems and interesting archæological tasks which drew me back to the regions where ruined sites long ago abandoned to the desert have preserved for us relics of an ancient civilization developed under the joint influences of Buddhist India, China, and the Hellenized Near East. I well remembered the openings for fruitful exploratory work which, on my previous travels, disproportion between the available time and the vast extent of the ground had obliged me to pass by, and I was anxious to secure these chances afresh while I could still hope to retain the health and vigour needed successfully to face the inevitable difficulties and hardships.

The arrangement of the large collection of antiques which I had brought to the British Museum from my former expedition, and the multifarious efforts which I had to organize and direct for their elucidation, helped by a staff of assistants and numerous expert collaborators, kept me busy in England until the very end of 1911. Work on the big publication which was to record the scientific results of that journey still continued to claim most of my time after I had returned to duty on the Archæological Survey of India, on the familiar ground of the North-West Frontier and Kashmir. That heavy task was not yet completed when in the autumn of 1912 a variety of considerations induced me to submit to the Indian Government my formal proposals for the long-planned expedition, by which I wished to resume my geographical and archæological explorations in Central Asia. Among these considerations regard for the favourable political conditions then actually prevailing in respect of the regions to be visited played an important part. In this connection I have reason to remember gratefully the shrewd advice by which two kind friends, Sir

Henry McMahon, then Foreign Secretary to the Government of India, and Sir George Macartney, H.B.M.'s Consul-General at Kashgar, helped me to decide for an early start.

The kind interest shown by H.E. Lord Hardinge, then Viceroy of India, in my past labours and in my new plans had from the first been a most encouraging augury. My gratitude for this help will be life-long. With it accorded the generous support which the Government of India in the Education Department, then under the enlightened direction of Sir Harcourt Butler, extended to my proposals. This included the payment in three successive years of a total grant of £3000 to cover the cost of the intended explorations, the Indian Government reserving to themselves in return an exclusive claim to whatever "archæological proceeds" my expedition might yield. It was understood that the new Museum of Indian Art and Ethnography planned at Delhi would be the first to benefit by prospective "finds."

For the geographical tasks, which formed a large and essential part of my programme, the ready assistance secured from the Indian Survey Department was of the utmost value. To Colonel Sir Sidney Burrard, Surveyor-General of India, I owed already a heavy debt of gratitude for the very effective help he had rendered towards securing and publishing the survey results brought back from my former journeys. He now kindly agreed to send with me my experienced old travel companion, Rai Bahadur Lal Singh, Sub-Assistant Superintendent of the Survey of India, and to make available also the services of a second surveyor of his department, Muhammad Yakub Khan, along with all necessary equipment and a grant to cover their travelling expenses. Thus the wide extension of our proposed fresh topographical labours was assured from the outset. For my geographical work I found also an asset of the greatest value in the moral support which the Royal Geographical Society generously extended to me, besides granting the loan of some surveying instruments. During the weary months of preparation, with all their strain of work and anxiety, and afterwards into whatever solitudes of mountains and deserts my travels took me, I never ceased to derive true encouragement from the generous recognition which the Society had accorded to my former efforts to serve the aims of geographical science. Nor can I omit to record here my deep sense of gratitude for the unfailing sympathy and friendly interest with which in their ever-welcome letters Dr. Keltie and Mr. Hinks, the Society's Secretaries, helped to cheer and guide me.

After having passed a Kashmir winter and spring over incessant work on *Serindia*, the detailed report on the scientific results of my second journey, there arrived by the middle of May the Secretary of State's eagerly awaited sanction for my expedition. Relying on the kind consideration which my plans had so often received before at the India Office I had ventured to anticipate, as far as I safely could, a favourable decision, and the lists of orders, etc., for the multifarious equipment needed were ready. Yet it

cost no small efforts to assure the completion of all the varied preparations within the short time available, considering how far away I was from bases of supply and friends who could help me. A careful survey of all the climatic and topographical factors determining the programme of my movements had convinced me that I could not safely delay my start across the mountains northwards beyond the very beginning of August. So the weeks which remained to me in the peaceful seclusion of my beloved Kashmir mountain camp, Mohand Marg, 11,000 feet above the sea, saw me hard at work from sunrise till evening. By July 23 I moved down from its Alpine coolness to the summer heat of the Kashmir Valley in order to complete our final mobilization at Srinagar in the spacious quarters which the kindness of my old friend, Mr. W. S. Talbot, had conveniently placed at my disposal for those last busy days in civilization.

There I had the satisfaction to find Rai Bahadur Lal Singh, my trusted old companion, duly arrived with all the surveying equipment, which included this time two 6-inch theodolites, a Zeiss levelling set, a Reeves telescopic alidade and two mercurial mountain barometers, besides an ample supply of aneroids, hypsometers, plane-tables, prismatic compasses, etc. With him had come the second surveyor, a young Pathan of good birth, with manners to match, and that excellent Dogra Rajput, Mian Jasvant Singh, who had accompanied every survey party taken by me to Central Asia. In spite of advancing years he had agreed to act once more as the Rai Sahib's cook, and to face all the familiar hardships of wintry deserts and wind-swept high mountains. At Srinagar I was joined also by two other Indian assistants, who, though new to Central-Asian travel, proved both excellent selections for their respective spheres of work. In Naik Shams Din, a corporal of the First (King George's Own) Sappers and Miners, whom Colonel Tylden-Pattenson, commanding that distinguished corps, had chosen for me after careful testing, I found a very useful and capable "handy man" for all work requiring technical skill. A Punjabi Muhammadan of Kashmiri descent, he proved in every way a worthy successor to Naik Ram Singh, whose devoted help on my second journey I owed to the same regiment, and whose tragic end I have recorded in *Desert Cathay*.

The other assistant, Mian Afrazgul Khan, a Pathan of the saintly Kaka-khel clan, and a Sepoy from the Khyber Rifles, was my own choice, and experience soon showed how much reason I had to be pleased with it. Originally a schoolmaster on the Peshawar border, with a sound vernacular education, he had soon after his enlistment in that famous Frontier Militia Corps been noticed for his topographical sense and superior intelligence. After a year's training in the Military Surveyors' Class at Roorkee, where he greatly distinguished himself, he was permitted by Sir George Roos-Keppel, Chief Commissioner, N.-W. Frontier Province, and Honorary Colonel of the Regiment, to join me as temporary draftsman and surveyor in connection with the excavations I was carrying on in the

spring, 1912, as Superintendent of the Frontier Circle, Archæological Survey. There I was soon impressed by his marked and varied ability, and when in addition I became aware of his energy and genuine love of adventure I did not hesitate to engage him as an assistant surveyor for the journey. Our small party was completed by two Indian servants; one of them, Yusuf, a man of somewhat "sporting" instincts, was to act as my cook, and the other, Pir Bakhsh, a worthy elderly person from the mountains north of Kashmir, as his substitute in case of illness—or some temporary outbreak of bad temper. The experience of previous journeys had warned me as to the necessity of this double string, and I owe it probably to its restraining influence that I was able to retain the services of both men in spite of all trials and bring them back to their homes in the end safely and in a state of contentment.

Ever since the plan of my journey was first formed I had been exercised in my mind by the difficulty of finding a practicable route which would take me across the great mountain barriers northward to the border of Chinese Turkestan on the Pamirs, and which was still new to me. By the initial portions of my previous journeys I had exhausted the only apparent alternatives of the Chitral and Hunza valleys leading to practicable crossings of the main Hindukush range. Even the devious route over the Karakoram passes I had seen on my return journey of 1908. But fortune seemed to favour me at the start, and unexpectedly to open for me the eagerly desired new approach to my goal.

For long years I had wished to explore the important valleys of Darel and Tangir which descend to the Indus from the north some distance below Chilas. Darel (*Ta-li-lo*) is prominently mentioned in the accounts of old Chinese Buddhist pilgrims, partly because there passed through it a route which some of them followed on their descent from the uppermost Oxus to the Indus and the sacred sites of the Indian north-west frontier, and partly by reason of a famous Buddhist sanctuary it once contained. No Europeans had ever been able to visit these territories, as the disturbed political conditions of the local tribal communities, coupled with their fanatical spirit, effectively closed access to them. But in recent years Raja Pakhtun Wali, of the Khushwaqt family, once ruling Yasin and Mastuj, had, after an adventurous career, succeeded in founding and gradually extending a chiefship of his own among these small Dard republics. The desire of consolidating his rule and securing support for his children's eventual succession had led him a short time before to seek friendly relations with the Gilgit Political Agency. When I learned of the opportune chance thus offering I decided to use it for a new route to the Pamirs. The matter needed diplomatic handling. But finally the effective help given by my kind friend the Hon. Mr. Stuart Fraser, Resident in Kashmir, with the assent of the Indian Foreign Department, secured for me the chief's permission to visit his territories. The conditions he thought fit to attach to it were obviously meant to safeguard

his political interests—and incidentally also my safety among his newly won subjects.

On 31 July 1913 I started from Srinagar, and proceeding by boat down the Jhelam, reached next day the little port of Bandipur on the Wular Lake. From there the bulk of our baggage was sent ahead with the second surveyor by the Gilgit military road to await us in Hunza. I myself with Lal Singh and Afrazgul left Kashmir through the side valley of the Lolab and struck north-westwards for the route which leads through the deep-cut gorges of the Kishanganga and its tributaries to the snowy passes of Barai and Fasat and then down to Chilas on the Indus. Bad weather pursued us from the time we entered the mountains, and even on the first eight days the tracks followed proved in many places impracticable for laden animals. But it seemed appropriate Alpine training for the ground ahead, and there was an antiquarian interest to compensate me for the fatigues encountered; for various topographical considerations indicate that it was by this direct route to the Indus and thence to Gilgit that the Chinese received those annual supplies from Kashmir which alone, according to an interesting historical document preserved in the Annals of the T'ang dynasty, enabled them about the middle of the eighth century A.D. to maintain for some years imperial garrisons in Gilgit and Yasin. Thereby they prevented the junction between their great adversaries who then threatened Chinese hold on Turkestan—the Arabs in the west and the Tibetans in the south. It was, of course, the human beast of burden which alone made the use of such a route possible, and we have historical evidence to show how abundant its supply was in ancient Kashmir.

By August 10 we had descended from the snowy range which culminates eastwards in the huge ice-clad pyramid of Nanga-parbat (26,620 feet above the sea) to Chilas on the Indus, the last British post towards the independent territory of Dard tribes, known as the Indus Kohistan. The *Pax Britannica*, brought some twenty years before to what was once the most turbulent and fanatical of these petty hill republics, had worked curious changes in the position of the cultivated areas, etc., which without definite records a future antiquarian or geographer would find most difficult to interpret correctly. The heat of the summer is great in the deep-cut rock defiles of the Indus, and the banks forbiddingly barren. So I was glad when our descent in the Indus gorge next day could be effected on a skin raft which the tossing current of the mighty river carried down at the rate of some 14 miles an hour. Though the snowy weather prevailing on the high ranges had caused the river to fall to some 24 feet below high-water level, yet the flood volume was still large enough to allow us to sweep down securely over what at other times is a succession of impassable rock ledges and rapids.

At the mouth of the Hodur stream we left the Indus behind and entered ground which offered ample scope for exploring work. Passing up the unsurveyed valley northward we found plentiful ruins of small

fortified villages clearly dating back to pre-Muhammadan times and a great deal of abandoned cultivation terraces for which the supply of irrigation water now available would manifestly no longer suffice. Pushing up to the Unutai Pass we crossed the range which overlooks the Khanbari River and there reached the eastern border of Pakhtun Wali's latest conquests. As we descended westwards through the Datsoi Nullah by a track almost impassable for load-carrying men we were met by Pakhtun Wali's capable nephew, Mehtarjao Shah Alim, with a large and well-armed escort. It had been stipulated beforehand that not a single man from the territory under control of the British Agency of Gilgit was to accompany us. The careful watch kept over us from the start by Pakhtun Wali's select men-at-arms, wherever we moved or halted, seemed to afford adequate protection from any fanatical attempt on the part of less trustworthy elements among his new subjects who might have liked to embroil him by an attack upon us. But I confess that it also at first caused me serious misgivings as to the freedom which might be left to us for useful topographical work.

It was quite as much regard for such work as the wish to avoid the excessive summer heat of the Indus gorges which had caused me to ask that we might be taken to Darel by the mountains at the heads of the Khanbari and Dudishal Valleys instead of the usual route, which leads through the former. It proved a difficult line of progress, even with such hardy porters for our baggage as Shah Alim had brought from the main Darel Valley. But its advantages for surveying operations were great, and fortunately I soon found that we were left full freedom to use them. The great spurs descending from the Indus-Gilgit watershed northward had to be crossed by a succession of high passes, between 13,000 and 14,000 feet, and these furnished excellent plane-table stations. The extensive views there obtained towards the great snowy ranges across the Indus and westwards on the headwaters of the Swat River permitted our positions to be fixed with accuracy from previously triangulated peaks. At the expense of much hard climbing we secured equally favourable conditions further on, and a protracted spell of fine weather made it easy to use them. R. B. Lal Singh, in spite of his fifty-one years, an age which Indians usually are apt to count as advanced, showed that he had lost none of his old zeal and vigour. Through his devoted exertions a fortnight's hard travel sufficed to map some 1200 square miles, on the scale of 2 miles to the inch, on ground which had never been surveyed or even seen by European eyes.

It was a pleasant surprise to find our tasks soon facilitated by the excellent relations we were able to establish with Mehtarjao Shah Alim and the band of Pakhtun Wali's trusted supporters who formed our ever-watchful guard. They were a strangely mixed crew, of distinctly shady antecedents, but all "handy" and pleasant to deal with. Most of these alert fellows were outlaws from Swat, Chitral, and the independent Dard republics on the Indus, who, with hands already blood-stained, had joined

Pakhtun Wali's fortunes at one time or other of his adventurous career. Their burly fair-haired commander Shahid, whose look of jovial ruffian curiously contrasted with his name, meaning "martyr," had from the beginning played a prominent part in all the mixed feuds and intrigues by which their capable chief had raised himself from the position of a hapless refugee in Tangir to that of absolute master of that once turbulent valley. The means and methods by which Pakhtun Wali, in true Condottiere fashion, had subsequently extended his sway over the neighbouring hill republics of Darel and Sazin, had been equally unscrupulous, and recalled times long gone by elsewhere. His was the most recent kingdom carved out in the Hindukush, a region probably less touched by historical changes than any other in the north-west of India, and to glean first-hand information about the process employed was for me a very instructive and fascinating occupation. Nor did quick-witted Shah Alim and his band of intelligent henchmen fail me when it came to collecting exact data about local resources, population, etc., or raising or managing needful transport. Fully familiar with the ground, as their employment had made them, they yet kept a mental detachment from the local interests, regard for which would have induced reticence among more settled subjects.

The Khanbari River was found to drain an unexpectedly large mountain area, and in all the valleys splendid forests of pines and firs, quite untouched by the axe, were found to clothe the higher slopes. In the wider portions below old cultivation terraces, now abandoned, could be traced for miles. Judging from the size of the trees, the forest which has overrun them in most places dates back for centuries. There is an abundant supply of water for irrigation from snowbeds and springs, and re-occupation of these fertile lands is retarded only by the great scantiness of population. Before Pakhtun Wali's conquest the Darelis had contented themselves with using the extensive grazing-grounds at the very head of the valleys, and only since the advent of more peaceful conditions has the slow immigration of Gujar settlers commenced. Whatever the cause of the original abandonment of these valleys may have been, it soon became obvious that they, like Darel and Tangir, enjoyed climatic conditions far more favourable in the matter of adequate rainfall than those prevailing higher up on the Indus or elsewhere between the Indus and the Hindukush. This abundant moisture may well be due to some feature in the orography of the Indus Valley, permitting the monsoon rains to advance here far beyond the line where their effect is stopped elsewhere by the high mountain chains southward.

The contrast with those denuded barren mountains to the north and east, which I remembered so well from my previous routes through Gilgit and Chitral, became even more striking as we descended from the Ishkobar Pass (*circ.* 13,650 feet) to the head of the main Darel valley. When encamped there at Nyachut, on rich Alpine meadowland and surrounded by mountain sides which magnificent forests of deodars and firs clothe for

thousands of feet in height (Fig. 1), I felt as if transported to the Sind or some other big side valley of Kashmir. Unfortunately there was little chance left to enjoy the delights of this glorious Alpine scenery while being constantly attacked by swarms of the particularly fierce mosquitoes which infest all Darel and Tangir. We met them first when approaching the Khanbari watershed from the east, and the trouble they gave steadily increased as we progressed. Even high up in the mountains we suffered severely from this plague which is apt to cause bad sores, as my surveyors and myself soon found by experience. There was little consolation in the fact that the local people suffer almost as much from the infliction, as their pock-covered skin showed, and that during the winter these tormentors descend to seek warmer quarters by the Indus. I often wondered whether their presence would not be an adequate defence of Darel against any permanent invasion by people concerned for their comfort.

When I moved down to the vicinity of Manikyal, the northern of the two extant walled townships of Darel, there revealed itself strikingly the remarkable openness of the main valley and the great extent of arable land on the wide plateaus flanking the middle course of the Darel River. The sight of this fertile area, all easy to irrigate, revealed at a glance the importance which Darel must have possessed in ancient times, and which with an adequate population and under a firm rule it could attain once more. But much of the land had passed out of cultivation long ago, and the great number of ruined sites gave striking confirmation of the observation The survey of these ruins, all known as *kots* (forts), kept me busy for several days, and showed that most of them were remains of fortified settlements dating back to pre-Muhammadan times. Rapid excavation near one of them, Bojo-kot, brought to light unmistakable relics of a Buddhist burial-ground in the shape of cinerary urns, metal ornaments, etc. These ruins always occupy naturally strong rocky ridges bearing elaborately built terraces, and by their position and constructive features curiously recalled to my mind the extensive ruined settlements of the Buddhist period with which my explorations in the Swat Valley and on the Peshawar border had rendered me familiar. Archæological evidence thus seemed to bear out the tradition preserved in the Chinese pilgrims' records as to the early historical connection between the ruling families of Darel and Swat.

All antiquarian observations pointed to the territory having been occupied in Buddhist times by a much denser population than the present and one possessed of far greater material resources. Yet even now Darel contains a number of large crowded villages, some, like Manikyal and Samagial, well deserving to be called towns. Again and again I was struck by lingering traces of an inherited civilization a good deal more developed than that to be found now in the neighbouring hill tracts. Thus the alignment of the irrigation canals and the carefully preserved solid stonework of the terraces and embankments over which they are

FIG. 1.—FOREST NEAR NYACHUT, HEAD OF MAIN DAREL VALLEY, LOOKING N.W.

FIG. 2.—DARELI GREYBEARDS ON CARVED SITTING PLATFORM, MANIKYAL.

FIG. 3.—LOWEST PORTION OF CHILLINJI GLACIER, SEEN FROM WEST ACROSS ABHKUMAN RIVER.

FIG. 4.—CAMELS DESCENDING KARA-TASH RIVER GORGE NEAR ARA-SUNDE.

carried showed unusual skill. Another very significant feature was the abundance in houses, mosques, and graves of fine wood-carving retaining decorative motifs which are directly derived from Græco-Buddhist art as known to us from the ancient relievos of Gandhara, and which occur frequently also in the ornamental wood carvings excavated by me at sand-buried old sites of Chinese Turkestan.

The racial type of the Darelis (Fig. 2), as far as I could judge without anthropometric observations, for the collection of which there was no time, seemed to me unmistakably akin to that of the other Dard tribes which occupy the adjoining mountain territories. This close relationship is also borne out by their Shina dialect. But there was something in the often refined features of the men, and their less heavily built frame, which vaguely suggested inheritance from generations weakened by a decadent civilization and a long period of internal disorder. They struck me distinctly as a race possessing the instincts of quasi-town-bred folk and needing a strong ruler.

On the evening of August 16 I was received by Raja Pakhtun Wali in full state at the castle of Gumare-kot, which he was building in the centre of his recently annexed territory and as a stronghold to safeguard its possession against possible risings. The steep ridge which rises above it is occupied by the ruins of the large fort of Raji-kot, marking the ancient capital of Darel. It was a very interesting experience to meet the man who, after a career as chequered as befitted the son of Mir Wali, Hayward's murderer, had succeeded in building up a new kingdom for himself, the last, perhaps, which India has seen raised on the old adventurous lines. His human environment, in which Darelis are still kept much in the background, and the methods by which he maintains his rule seemed to call up times long gone by. There was much to claim my interest in what I heard from the shrewd and energetic Khushwaqt chief that evening, and during the long visit he paid me next morning with his two young sons; but this is not the place to record it. He had spared no care nor trouble to facilitate my safe journey through his territory and to make it as profitable as the limitations of my time permitted. I shall always look back with gratitude to the friendly welcome accorded, and with genuine interest and sympathy to the ruler.

It was a special satisfaction to me that on my way down Darel I was able to identify at Poguch the site of an ancient Buddhist sanctuary which the Chinese pilgrims specially mention on account of its miracle-working colossal image of Maitreya Buddha in wood. The tomb of Shahakhel Baba, a Muhammadan saint renowned for his miraculous powers and attracting pilgrims from many distant parts of the Hindukush region as well as Swat and the Indus Valley, attests here the continuity of local worship. Lower down we passed interesting ruins of castles once closing access to Darel. Then we ascended westwards by a precipitous track, difficult for load-carrying men, to the rugged high spur which divides

Darel from Tangir. On reaching its top we were rewarded for a trying climb over bare rock slopes by the grand vistas which opened before us. Owing to its isolation the Shardai Pass commands wide views of Darel, Tangir, the Indus Valley, and the ranges beyond, and proved a truly ideal survey station. To the west there showed clearly the gap between precipitous snow-capped spurs, where the Indus makes its sharp bend to the south. Access to this famous defile, where the bed of the mighty river is reported to contract into an exceedingly narrow rift, is closed by independent tribal territory. Even from afar European eyes saw it now for the first time. How I wished that Pakhtun Wali's expansionist policy might open the route some day for exploring those Indus gorges, where the old Chinese pilgrims made their way south by dreaded rock ledges and "iron chains suspended across chasms"!

The descent to the Tangir River over cliffs and vast slopes of rock débris was a trying experience; but the valley itself proved remarkably open and fertile. Fruit trees and vines were more plentiful than in Darel, and the mosquitoes a little less fierce. The population is scattered in clusters of hamlets, and showed a manly bearing. Of those fortified villages in which the Darel people seem to have always sought shelter since early times I could trace no ruins here. I had a very pleasant reception at Jaglot, where Pakhtun Wali had established his original stronghold, and where his family ordinarily resides. The original modest structure which he occupied as a refugee from Chitral had witnessed a memorable siege by the powerful Gabar-khel tribesmen who hold the upper portion of Tangir, and who then vainly tried to rid themselves of their ambitious exile-guest. Their defeat marked the first stage in Pakhtun Wali's rise to power. The old animosities seemed to be still smouldering here, and as we moved up the valley our ever-watchful escort took special care to safeguard us from any attempt of Pakhtun Wali's old foes, or the fanatical *talib-ilms*, or religious students, gathered in numbers round a famous Mullah at the mosque of Kami.

In the great forest belt at the head of the Satil branch of the valley hundreds of Pathans from Upper Swat and the independent tracts lower down the Indus were engaged in cutting the magnificent timber, an important source of revenue to Raja Pakhtun Wali. The timber is made to float down the Indus under arrangements with Kaka-khel traders, who, owing to the sanctity enjoyed by their clan, are able to exploit this business in tracts otherwise far too risky. Here we were joined by Mian Shahzada, the uncle of Afrazgul, my Kaka-khel surveyor, who for years had been in charge of these operations, and whose opportune intercession had helped to overcome the Raja's original scruples about our passage. Shahzada had charged himself with the responsibility of keeping all fanatical characters in these woodcutters' camps out of mischief, and by his effective help amply earned the recommendation I could give him to the district authorities of his far-off home on the Peshawar border.

All arrangements worked smoothly to the end, and when on August 21 we safely reached the Sheobat Pass, over 14,000 feet in height, on the range which forms the watershed between the Indus and the Gilgit River drainage, it was with regret that I left behind Pakhtun Wali's fascinating dominion, from which we had just "lifted the Purdah." I was sorry to bid farewell to our hardy escort of outlaws, after meeting the large *posse* of respectable Gilgit levies which had waited on the other side of the pass to take charge of us. It was amusing to watch the ill-disguised expression of distrust with which the latter viewed our quondam protectors, some of them well remembered, no doubt, from their old raids and similar exploits. The ample and richly deserved rewards I gave to Pakhtun Wali's men, however, sufficed to efface any unpleasant reciprocal feelings.

In order to reach the big Yasin Valley through which our northward route was to lead, we had first to gain the Gupis post on the Gilgit River. The mountains to the south of the latter have not yet been adequately surveyed. So it was scarcely surprising that the unexplored pass above Gafarbodo, which I chose as a short cut, proved nearly impossible for our load-carrying men. It took fully eight hours' scrambling over huge masses of rock débris left behind by ancient glaciers, the worst I ever encountered in this region, to reach the pass at an elevation of close on 16,000 feet.

Then I pushed up rapidly in the open and relatively fertile valley of Yasin. It leads due north, flanked by mighty spurs which descend from the glacier-crowned main Hindukush range, and has always been an important route, as it forms the nearest connection between Oxus and Indus. I found myself thus on ground claiming distinct historical interest, and there was a good deal even in things of the present to attest the strong Central-Asian influence to which it has been subject since early times. In addition to much fine old wood-carving in dwellings and mosques, I was able to trace a ruined Stupa with relics of Buddhist times and the remains of several old forts, which tradition significantly enough connects with early Chinese invasions.

It was owing to an early and historically well-attested Chinese conquest of these valleys from the uppermost Oxus that I felt a special interest in the glacier pass of the Darkot by which we crossed on August 29 to the headwaters of the Yarkhun or Mastuj River. It had been the scene of that remarkable exploit by which a Chinese force, despatched in 747 A.D. from Kashgar against the Tibetans, had effected its entry into Yasin and Gilgit. Already in May 1906, on my way up from Chitral, I had been able to ascertain how closely the topographical features of the Darkot Pass agreed with the exact account which the Chinese Annals of the T'ang dynasty have preserved for us of General Kao Hsien-chih's famous expedition. I had then succeeded in reaching the top of the pass, 15,400 feet above the sea, from the Mastuj side; but no examination of the southern approach, which also figures in that account, had been possible.

In view of the very serious natural obstacles presented by the glaciers

of the Darkot, Kao Hsien-chih's passage deserves to rank as a great military achievement, like his successful march across the whole width of the Pamirs, with a relatively large Chinese army, which preceded it, and to which I shall have occasion to refer further on. So it was a particularly gratifying find when I discovered an old Tibetan inscription scratched into a large boulder on the track where it ascends by the side of a steep moraine flanking the southern glacier of the Darkot. It is very probable that it is a relic of that short-lived Tibetan advance on the uppermost Oxus which the T'ang Annals record towards the close of the second quarter of the eighth century, and which Kao Hsien-chih's adventurous expedition successfully stopped.

On the top of the Darkot I was met by Captain H. F. D. Stirling, of the 57th (Wilde's) Rifles, then commanding the Chitral Scouts, with fresh transport from the Mastuj side. Thus the descent over the big and much-crevassed northern glacier could be effected without undue risk to men or baggage. I have special reason to feel grateful for the most effective arrangements made by Captain Stirling as I pushed on eastwards after crossing the Darkot. Our easiest route to the Chinese border would have led over the Baroghil saddle to Sarhad on the Oxus and thence across the Afghan Pamirs along the line I had followed in 1906. But apart from the fact that its use would have required the special permission of H.M. the King of Afghanistan, I was anxious to see new ground, and was therefore glad to move now by a parallel but far more difficult route by which westernmost Hunza could be gained from the headwaters of the Yarkhun and Karambar (or Ashkuman) Rivers. This route allowed me to sight the Showarshur branch of the Darkot Glacier, now completely closed by an impassable ice-fall, and to examine more closely the interesting instance of bifurcation by which the glacier above the Karambar saddle discharges its drainage partly towards the Yarkhun or Chitral River and partly into the lake forming the head of the Karambar River (Fig. 5). On its south side the route skirts an almost unexplored region of high ice-clad peaks and big glaciers, and the snouts which the latter have pushed across the gorge of the Karambar River (Fig. 8) together with the huge old moraines encountered in the main valley lower down constituted serious obstacles. They made all the more welcome the friendly help given by Captain Stirling, who, as an expert mountaineer, took pleasure in accompanying me on those four days of hard marching and climbing.

Beyond the Ashkuman River we were met by fresh porters, collected from the settlement of hardy Wakhi immigrants lower down that much-confined valley. The ascent made with them on September 2 to the Chillinji Pass (*circ.* 17,400 feet high) proved a difficult task (Fig. 3). The snowy weather prevailing all through August had rendered the very steep snow slopes to be climbed still more trying, and had added greatly to avalanche risks. The pass had not been traversed by any one for a long number of years, and only one old man sent with us had ever been across. So it

was a great relief when after eight hours' toil we safely reached the col, nearly 5000 feet above camp. It offered a grand view over the extensive glaciers which meet at the head of the Chapursan Valley, but the icy gale sweeping it made even a short rest difficult. Fortunately the great glacier below us proved less trying, owing to the fresh snow which had adequately covered up most of the crevasses, and after a descent of five hours more we found a dry spot by its side where we could bivouac in safety under the shelter of a moraine. Some of our coolies did not turn up till next morning, but they had wisely kept moving all through the bitterly cold night. Their safe arrival caused me great relief; and so also did the assurance that my feet, in spite of the loss of toes and the impaired circulation which resulted from my frost-bite accident at the close of the former journey, could stand well thirteen hours' struggle over snow and ice. The snout of the Chillinji Glacier was not passed until after a descent of another four miles in the morning, and a short distance beyond I had the satisfaction to find fresh transport from Hunza awaiting us. The arrangements made weeks ahead through my old acquaintance Humayun Beg, the Wazir of Hunza, had not failed me.

After this experience our progress through Hunza seemed easy. The Chapursan Valley, in spite of the huge moraines which the glaciers south have pushed down into it, contains more stretches of level ground than probably all the rest of Hunza. It was hence a feature of special interest to note the extensive areas of old cultivation which we passed on the 25 miles' march between Baba-ghundi and Spandrinj. Neither want of water for irrigation nor present climatic conditions at this elevation from *circ.* 11,000 to 10,300 feet seem to furnish an adequate explanation for their abandonment. Re-occupation is recent and proceeding slowly.

By September 5 we had reached the head of the main Hunza Valley over the Kermin or Rich Pass. Crossing two days later the border of Chinese Turkestan on the Mintaka Pass (15,430 feet) I found myself restored to ground familiar from my two former journeys. But how easy the previously followed routes seemed by comparison with our recent tracks! Since leaving the Kashmir Valley we had crossed altogether fifteen passes between 10,000 and 17,400 feet in height. The total marching distance covered during these five weeks was over 500 miles, and of this nearly four-fifths had needs to be done on foot.

Rapid as was my descent down the Taghdumbash Valley to Tash-kurghan, I could use it for fresh surveys of antiquarian interest. It must suffice here to mention an ancient canal of large size, famous in local lore but abandoned for long centuries, which had once brought fertility to extensive areas along the right river-bank, now almost wholly desert. We could trace its remains, in places remarkably well preserved, for a distance of over 40 miles, from Dafdar to below Toghlan-shahr. There, opposite to Tash-kurghan, still as in ancient times the chief place of Sarikol, I found also ruins of Buddhist shrines which had previously escaped me.

On leaving Sarikol for Kashgar I followed for a couple of days the main caravan route through the mountains. I was here on the track of Hsüan-tsang, the great Chinese Buddhist pilgrim whom ever since my first journey I claim as my patron saint. So it was a special satisfaction when on crossing the high plateau of the Chichiklik Maidan, already under fresh snow, I found conclusive evidence that a badly decayed enclosure, now worshipped as a sacred site by Muhammadans and used as a burial-place for unfortunate wayfarers, represents, as I had previously conjectured, the remains of an ancient hospice which Hsüan-tsang described as a place connected with a sacred Buddhist legend.

Beyond this our routes divided. Lal Singh moved off by rapid marches in order to reach, *viâ* Yarkand and Khotan, that portion of the main Kun-lun range along which I was anxious to have our triangulation of 1906 extended as far as possible eastwards. My heavy baggage was despatched to Kashgar by the usual route *viâ* Ighizyar under Afrazgul and Shams Din. I myself set out due north with the second surveyor in order to reach the same goal by a new route, across the Merki Pass and down the valley of the Kara-tash or Beshkan River which receives most of the eastern drainage of the great glacier-clad range of Muztagh-ata. Owing to special difficulties this important valley had never been explored in its whole length. In the spring and summer the narrow gorges of the Kara-tash River are rendered quite impassable by the big floods of the melting glaciers. By the time these floods subside in the autumn, heavy snow on the Merki Pass equally closes the route to traffic. In the spring of 1906 I had sent my late surveyor, plucky Rai Ram Singh, to descend the valley, but his attempt was completely baffled. Chance showed more favour to me now. An exceptional succession of early snowfalls had stopped the melting of the glacier ice just in time to allow of my passage while the Merki Pass (14,500 feet), though deep under snow, could still be traversed with laden yaks. But even thus the descent through the river gorge for two long marches proved a very difficult and in places risky business. The constant crossings of the river tossing between sheer rock walls could not have been safely effected without opportunely secured Kirghiz camels, and none but such hardy local camels accustomed to the ground could have negotiated the boulder-strewn narrow tracks leading elsewhere along the foot of these precipices (Fig. 4).

By September 19 we had safely emerged from the last of these gloomy defiles, and two days later a 40 miles' ride through fertile plains carried me back to Kashgar. There I had the great joy of being received once again, after seven years' absence, by my old and ever-helpful friend, Sir George Macartney, under the hospitable roof of Chini-bagh, now much enlarged and rebuilt as befitted its new dignity as a British Consulate-General. The two busy weeks passed in those familiar cheerful surroundings would certainly not have sufficed for all the heavy work which the organization of my caravan demanded, had not the watchful

care and often proved prevision of my kind host aided me in every direction.

In due course there arrived twelve fine camels from Keriya, accustomed to desert work and selected by Hassan Akhun, my experienced old camel factotum who was now about to embark on the third of our long expeditions into the "sea of sand." Other faithful old Turki followers, too, were glad to take their place again in my caravan. I had been delighted to see again at Kashgar my devoted Chinese secretary and friend, Chiang-ssu-yeh, who had proved so valuable on my second journey. Since then he had been rewarded by being appointed Chinese Munshi at the Consulate-General. But notwithstanding this comfortable berth I think he would have been glad to rejoin me had not his increasing years and a serious affection of his ears warned me against accepting the sacrifice and risks which such a step would have involved for my old companion.

Li-ssu-yeh, the shrivelled-up weakly young man whom Chiang provided for the post of camp-*literatus*, turned out to be a poor substitute, as I had apprehended from the first. But there was no other choice at Kashgar. Wholly absorbed in the task of treating his ailments, real and imaginary, with every Chinese quack medicine he could lay hold of, and as taciturn and inert as a mummy, Li was useless for the manifold scholarly and practical labours in which Chiang had engaged with such cheery energy. But anyhow he managed to indite my Chinese epistles, and he did not play me false in my dealings with Chinese officials.

For this negative virtue I had reason to feel specially grateful. The revolution of 1911 had greatly changed many aspects of Chinese officialdom even in this distant province, and scarcely for the better. A series of assassinations of Mandarins, and petty outbreaks fomented by unscrupulous office-seekers, had during 1912 seriously disturbed the peace of the "New Dominion," though they were confined to the numerically weak Chinese element, and left the mass of the people, respectable Turki Muhammadans, in their characteristic unconcern. It had been due largely to the wise counsels and moderating influence of Sir George Macartney, who for many years past has enjoyed wide and richly deserved respect among all classes, that the province had escaped complete anarchy. Under the influence of a somewhat stronger régime at headquarters things had become more settled before the time of my return. But it was difficult not to realize that the so-called revolutionary movement in Hsin-chiang had in various respects adversely affected the general type of officials in power. Some of the best qualities of the old local Mandarin world, including regard for scholarly aims and labours, had manifestly been discarded, while the beneficial effect hoped for from "Western learning" and republican methods was still conspicuous by its absence. There was only too much justification for Sir George Macartney's shrewd warning that I could not safely reckon upon finding always the same favourable disposition at Chinese Yamens which had facilitated my explorations so much during previous journeys.

After a stay which reunion with the kindest of friends, Sir George and Lady Marcartney, and the glorious autumn season had combined to render most pleasant, I left the Kashgar Consulate-General on October 9 for my first winter's work in the desert. Its main goal was the region around the dried-up Lop-nor, in the extreme east of the Tarim Basin, and the whole length of the Taklamakan, that great sea of drift-sand over 600 miles in a straight line, separated me from it. A variety of considerations obliged me to revisit Khotan, and once there I was bound to proceed by the only possible route which skirts the southern edge of the Taklamakan. Much of the ground to be traversed there was already familiar to me from my previous expeditions, and for this reason I was all the more eager to use whatever chance of new routes the limits of time left me on my way to Khotan.

This induced me to move first due east to the oasis of Maral-bashi along the foot of the steep and barren mountain chain which forms here the southernmost rampart of the Tien-shan. It had in its main part remained so far unsurveyed; but reports, previously collected, seemed to indicate that an old route, now but vaguely remembered in local lore, had during earlier periods of Chinese domination skirted the foot of that chain and been in use for traffic instead of the present high "road," *recte* caravan track, leading much further south along the actual course of the Kashgar River. The accurate survey now effected confirmed that tradition and proved the existence of a series of small ruined sites scattered along a line of some 160 miles and dating from pre-Muhammadan times. The ground occupied by them on the gentle desert glacis of the hill chain is now wholly without water. There were also other physical observations of interest to be gathered, clearly pointing to desiccation within historical times, and not explainable by the fact that the winding bed and inundation marshes of the Kashgar River were found to have at one period, perhaps relatively recent, approached that desert glacis in places more closely than they do at present. We had met with serious trouble about water, no drinkable supply having been found on three successive marches. This served as a suitable preparation for difficulties to be faced on our desert travel ahead.

By October 18 we were glad to reach the fields and fruit-gardens of Maral-bashi. The survey of some badly injured Buddhist ruins in the vicinity, and of the curious canal system by which the oasis obtains the major portion of its by no means abundant irrigation from the Kashgar-darya here approaching its end, occupied me for a few days. But in the main my short stay was taken up with careful preparations for the attempt I planned to make my way to the desert hills of the Mazar-tagh on the lower Khotan River by a short cut through the Taklamakan. I knew well the formidable obstacles and the risks presented by the wide intervening belt of absolutely waterless drift-sand desert. But by sending all baggage, except an absolutely necessary minimum, to Khotan by the caravan route

Ak-kul Lake.

Karambar Valley.
Old moraines in foreground.

S. Shitam Glacier.

High range between Ghund and Shakhdarra Valleys.

East Karambar Glacier,
with bifurcating drainage.

FIG. 5.—PANORAMIC VIEW TAKEN FROM KARAMBAR SADDLE (CIRC. 14,050 FEET ABOVE SEA

The view extends from north-east, on extreme left (main Hindukush watershed towards O

Arête forming Shitam Pass.

Distant Badakhshan ranges.

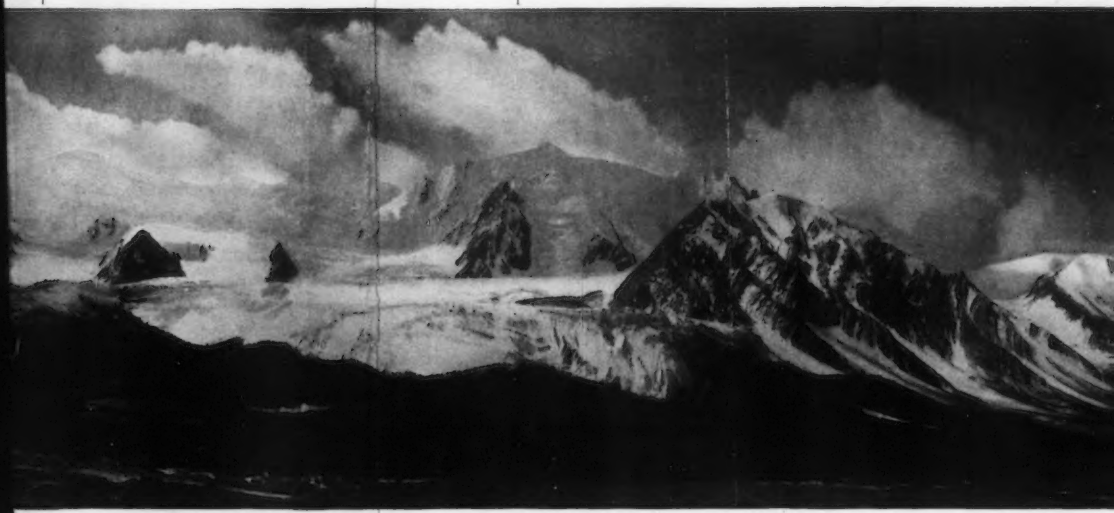
FIG. 6.—PANORAMIC VIEW TAKEN FROM SHITAM PASS (CIRC. 16,100 FEET ABOVE

The view extends from south, on extreme left (high range dividing Ghund and Shakhdarra Valleys),

Karambar Glacier,
urcating drainage.

Main Karambar Glacier feeding
Yarkhun River.

Glaciers



SADDLE (CIRC. 14,050 FEET ABOVE SEA) DIVIDING HEADWATERS OF KARAMBAR AND YARKHUN, OR MASTUJ, RIVERS.
reme left (main Hindukush watershed towards Oxus), to west-south-west, on extreme right (uppermost Yarkhun Valley).

Badakhshan ranges.

Glaciers feeding large ice-st

TAM PASS (CIRC. 16,100 FEET ABOVE SEA), ON WATERSHED RANGE BETWEEN SHUGHNAN AND ROSHAN.
ange dividing Ghund and Shakhdarra Valleys), to north-west on extreme right (range between Roshan and Yazghulam Valleys).

Glaciers above Murghach.

Peaks above Darkot and Chatiboi Glaciers.

RIVERS.

arge ice-stream at head of Raumedh Valley.

Range north of Roshan Valley.

FIG. 7.—MARCH AMIDST DUNES OF TAKLAMAKAN, SOUTH-EAST OF CHOK-TAGH
High ridge of sand seen in background.

FIG. 8.—SNOUT OF NAMELESS GLACIER BLOCKING KARAMBAR RIVER BELOW RUKHNI.

FIG. 9.—TAMARISK-COVERED SAND CONES ABOVE WIND-ERODED GROUND NEAR ANCIENT TERMINATION OF NIYA RIVER.

FIG. 10.—WIND-ERODED REMAINS OF ANCIENT ORCHARD (3RD CENTURY A.D.), NIYA SITE.

Posts for trellis, once carrying vines, on right, and tamarisk cones in background.

FIG. 11.—GROUND CUT UP BY WIND EROSION INTO CLAY TERRACES, SOUTH-WEST OF LOU-LAN SITE.

Dead tree-trunks in distance on left mark ancient river course.

FIG. 12.—INTERIOR OF ANCIENT FORT WITH WIND-BREACHED PORTION OF RAMPART, SOUTH-WEST OF LOU-LAN SITE.

Heavy timber débris in foreground marks position of completely eroded structure.

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viâ Yarkand; by reducing in the same way my camp to a few indispensable followers, and keeping most of our fine camels for the transport of water in my six galvanized iron tanks and the very numerous goatskins I had brought from India, I could hope safely to overcome the difficulty about water. The advent of the cold season would help our brave camels to face a long fast from grazing and water.

Apart from the attraction presented by the short cut and the fascination of such a desert cruise, there was an important geographical task to justify the enterprise. Our surveys of 1908 had shown reason for the belief that the Mazar-tagh hills, then traced for over 20 miles into the Taklamakan, belonged in geological structure to an ancient range which started at an angle from the outermost T'ien-shan near Maral-bashi and once extended across the Taklamakan in a south-easterly direction. The way in which the bold island-like hills to the east of Maral-bashi have been carved out and isolated by the manifest action of wind-driven sand prolonged through endless ages left little doubt as to how the continuity of that assumed ancient hill range had been broken up. But only actual survey of the ground could supply definite proof.

On October 25 I left Maral-bashi with six hired camels, all I could secure, to act as a "supporting party" to lighten the loads of our own on the initial stages of the desert journey, and three days later we reached the last of those sand-scoured hills in the desert south-eastwards, known as Chok-tagh. From a lake near it, which inundations from the Yarkand River feed but which we found brackish at its end, Hedin had started in May 1896 on that bold journey through the sandy wastes eastward which ended with the destruction of his caravan and his own narrow escape. Steering a south-easterly course we forced our way for three trying marches into the sea of dunes. Closely packed and steep from the start, they grew steadily higher and invariably rose in a line running diagonally across our intended direction. By the second day all trace of vegetation dead or living was left behind, and an endless succession of mighty ridges, with not a patch of level sand between them, faced us (Fig. 7). The ridges to be climbed soon reached 200–300 feet in height, and progress became painfully slow with the heavily laden camels. Careful levels taken along our track showed an aggregate ascent of some 400 feet over a single mile's distance, with corresponding descents even more trying to the camels.

It was by far the most forbidding ground I had ever encountered in the Taklamakan. By the evening of the third day the hired camels of the "supporting party" had either broken down completely or showed serious signs of exhaustion. Next morning I ascended the highest dune near our camp, and carefully scanning the horizon saw nothing but the same expanse of formidable sand ridges like huge waves of an angry ocean suddenly arrested in movement. There was a strange allurement in this vista suggesting nature in the contortions of death. But hard as it seemed to resist the Syren voices of the desert which called me onwards, I felt

forced to turn northward. Though we men might have struggled through, I should probably have had to incur the needless sacrifice of some of our brave camels which were to be the mainstay of our transport for the winter's explorations, besides the loss of indispensable equipment. It was as well that I took that hard decision in time; for by the third day after there sprung up a violent 'Buran,' which, by its bitter cold, proved most trying even where fuel was abundant, and if met with amidst the high sand ridges would have brought us to a stand-still and caused serious suffering and risks.

Sorry as I was to give up the effort two interesting discoveries had already rewarded it. Again and again we had come between the high dunes upon patches covered with minute but easily recognizable fragments of rock flakes of the wind-eroded hill range once extending right through to the Khotan River. Elsewhere, fully 30 miles from the nearest traceable bed of the Yarkand River, a small belt of eroded ground displayed on its surface abundant remains of the Stone Age, proving occupation by a Palæolithic settlement of what is now absolutely lifeless desert. Neolithic arrow-heads turned up on similar ground nearer to Chok-tagh.

After crossing the Yarkand River behind that hill chain we fortunately secured ponies from a grazing-ground, and were thus enabled to push on rapidly through hitherto unsurveyed tracts of riverine jungle, largely dead, to where, near Gorachöl, the last dried-up offshoots of the Kashgar-darya bed lose themselves. Thence, with fresh animals, we gained the delta of the Khotan River by a route not previously surveyed. It showed me the great change which, since my passage of 1908, had taken place in the river's terminal course. A series of rapid marches by the Khotan-darya, then completely dry, carried me back to the end of the Mazar-tagh range I had first visited in 1908. There I found the transport and labourers ordered ahead from Khotan duly awaiting me, and was able by resumed spade-work to secure interesting archæological results at the ruined fort. Besides additional written records of Tibetan times there came to light remains of a Buddhist shrine, immediately below the alleged Muhammadan saints' tombs, from which the desolate desert hill derives its present designation. Thus the continuity of local worship, so important a feature in the history of Asiatic religious beliefs, received another striking illustration.

On November 21 I regained my old haunts at Khotan town, and was cheered by a warm welcome from my old local friends. A brief halt necessitated by manifold practical arrangements was used also to gather such antiques as my old friend the Indian Aksakal Badruddin Khan, now rewarded by the title of Khan Sahib for his help in the past, and others had collected for me from Yotkan, the site of the ancient Khotan capital, and from the desert sites which Khotan "treasure-seekers" are in the habit of annually searching. On November 28 I left the familiar base of my former expeditions to resume the long journey eastwards. There

was still a marching distance of close on 700 miles separating me from Lop-nor, and it was essential for the work planned in that desert region that I should reach it in time while the winter cold lasted and allowed water to be transported in the convenient form of ice.

But rapid as my progress had to be I could not forgo such convenient opportunities for archæological work as familiar sites near my route still held out. Thus we recovered some interesting fresco remains from the ruin of a Buddhist shrine which had come to light since my last visit in the area of tamarisk-covered cones of sand north of Domoko, near which Hsüan-tsang's *Pi-mo* (Marco Polo's Pein) must be located. From the Niya oasis, which was reached on December 9, I revisited the fascinating sand-buried settlement in the desert northward below the pilgrimage place of Imam-Ja'far-Sadik. Abandoned to the desert since the third century A.D., it had yielded plenty of important relics and records in the course of my former explorations. But owing to the deceptive nature of the dune-covered ground and other reasons, it had not been possible to exhaust it completely. It did not disappoint me now either. By a close search of previously unexplored ground to the south-west of the main portion of the ancient oasis we discovered more ruined dwellings of the same early period hidden among the high tamarisk-covered sand-cones (Fig. 9). The employment of a large number of diggers rendered rapid clearing possible also in the case of certain structures which before had seemed too deeply buried in the sand for complete exploration. Thus, apart from furniture, household implements, etc., we recovered a further collection of Kharoshthi documents on wood, written in the Indian language and script which had prevailed in official and Buddhist ecclesiastical use from Khotan to Lop-nor during the first centuries of our era.

It was a particularly curious discovery when, not far from the still traceable dry river-bed, we came upon the remains of a large and remarkably well-preserved orchard, where the carefully arranged rows of various fruit trees and the trellis-carried vines, though dead for many centuries, could be examined in almost uncanny clearness (Fig. 10). It was not surprising to find there also the rafters of a foot-bridge, once spanning the river, still stretched out across its dry bed. It had meant a week's constant work under high pressure, and it was only by the light of bonfires that the final excavation of the large structure was finished, which in 1901 we had called the Yamên. It was a curious chance that just its last room, which then had baffled us by its deep sand, proved to contain those "waste papers," *i.e.* wooden records, of the office, we had before vainly hoped for. It seemed like a farewell gift of the ancient site which I had somehow come to look upon as my own particular estate, and I found it hard to tear myself away from it.

No appropriate return was possible to the dead. But at least I could do something for those living who were nearest. My renewed visit to this ground had allowed me also to make observations of direct geographical

interest concerning changes in the terminal course of the dying Niya River, etc. Among these I had noticed the instructive fact that cultivation at the tiny colony of Tulkuch-köl, established at the very end of the present river-course, below Imam-Ja'far-Sadik's Ziarat, had recently been abandoned, not from want of water, as the usual theory might have suggested, but, on the contrary, owing to a succession of ample summer floods which carried away the canal-head, and with which the locally available labour could not cope. My resumed excavations had brought a large *posse* of able-bodied labourers near the spot. So when I had come back with them from the ruins and was leaving, they were set to work to raise a new barrage across the deep-cut flood-bed, and thus secure water for the little canal, a couple of days' work. As I deposited the small sum needed for their wages with the Mazar Shaikhs, the task was carried through with a will.

From the end of the Niya River I led my caravan through unexplored desert, with high sand ridges in places, and more of salt-encrusted and often boggy ground, to the Endere River. Thence we had to follow the old caravan track to Charchan, which we reached by December 28. It was bitterly cold in the desert, with minimum temperatures down to 50° Fahr. below freezing-point. But there was compensation in the exceptionally clear weather, which allowed us to sight day after day the grand snow-clad rampart of the main Kun-lun range far away to the south. At most seasons it remains quite invisible from the caravan track connecting Charchan with Niya and Keriya. In 1906 numerous peaks on it had been triangulated by Rai Ram Singh, and with their help we could now map our route to Charchan and onwards, far more accurately than had been previously possible.

At Charchan I found the oasis distinctly increased since my last visit, and was able to pick up nine additional hired camels badly needed for the work ahead in the Lop region. But the news received about events which were said to have occurred at Charkhlik, its chief inhabited place, was by no means welcome. A band of Chinese "revolutionaries," *recte* gamblers and adventurers, had a short time before started for that place from Charchan, and was reported to have attacked and captured the district magistrate of Charkhlik, besides committing other outrages *en route*. The Chinese sub-divisional officer of Charchan had been helpless to prevent the outbreak, and was evidently sitting on the fence. He considerately provided me with two introductions for Charkhlik, one to the unfortunate Amban, assuming that by any means he had regained freedom and authority, and the other for the leading spirit of the "revolutionaries," whom he shrewdly guessed to have been installed in office instead of him.

We left Charchan on New Year's Eve, 1914, and did the desert journey to the western border of the Lop district by seven long marches, mainly through the jungle belt on the left bank of the Charchan-darya, which was a route new to me. Splendidly clear weather favoured us, and so did the severe cold, which had covered the river and its marshes with strong ice.

We did not meet with a single wayfarer, which struck me as strange at the time. On approaching the jungle belt of Vash-shahri, an outlying little colony of Lop, we found the route guarded by a large party of armed Muhammadans, who at first mistook us for a fresh batch of "revolutionaries" (many of the Chinese had taken to masquerading in queer European clothes). But Roze Beg, the headman of Vash-shahri and an old acquaintance, soon recognized me. From him I learned the queer story how the little band of "gamblers" from Charchan had captured the hapless Amban, all the local Muhammadans first deserting him, and then looking on with placid indifference when some days later their magistrate was cruelly put to death by the bandits, after having been forced to disclose the place where his official moneys were hidden. The leader of the band had set himself up as Amban *ad interim*, and was duly obeyed by the local chiefs, Roze Beg himself included. Fortunately his régime proved short-lived, and there was no need of my introduction to him either; for within a week a small detachment of Tungan Government troops had arrived from far-away Kara-shahr in the north, under a capable young officer. Stealthily introduced at night into the oasis by the same adaptable Begs, they found little difficulty in surprising the "revolutionaries," most of whom were killed in their sleep and the rest captured. So tranquillity once more ruled at Charkhlik, and Roze Beg was now engaged in laying an ambush for more "gamblers" expected to come from Charchan, in ignorance of the turn their affairs had taken. In this loyal task he duly succeeded within a day of my passage.

On January 8 I arrived at Charkhlik. It was from this modest little oasis, the only settlement of any importance in the Lop region, representing Marco Polo's 'City of Lop,' that I had to raise the whole of the supplies, labour, and extra camels needed by the several parties for the explorations I had carefully planned during the next three months in the desert between Lop-nor and Tun-huang. I knew well the difficulties which would attend this task even under ordinary conditions. But now I found them greatly increased by the preceding local upheaval and all its consequences. The irruption of the "revolutionaries" and its subsequent repression by the Tungan troops, who had "by mistake" killed even the few Chinese subordinates of the legitimate Amban, had left no Chinese civil authority whatever, and in its absence no effective help could be hoped for from the easy-going Lopliks and their indolent Begs. The trouble about adequate supplies and transport became all the more serious as the passage of relatively large bodies of Tungan troops sent to operate against the numerous "revolutionary" elements which were known to lurk among the Chinese garrisons of Keriya and Khotan, threatened completely to exhaust the slender resources of Charkhlik.

The six days' stay I was obliged to make at Charkhlik in order to secure at least a portion of my requirements through the help of a few old Lop friends, was thus an anxious time for me. I greatly chafed at the

delay, little realizing at the time what a boon in disguise the revolutionary disturbance had been for me. Fortunately I was able to use my stay also for some profitable archæological labour. While executions of captured rebels, requisitions for the troops marching on towards Keriya, etc., kept the little oasis in unwonted animation, I managed to search two small sites near by on the river but beyond the southern edge of cultivation, which previously had escaped me. From ruined Buddhist shrines there I recovered remains of Sanskrit manuscripts on birch-bark, palm-leaf, and silk, fragmentary but of special interest as suggesting import from India by the direct route which still leads from Charkhlik across the Tibetan plateaus to the south.

On the last day of my stay I had the great satisfaction of seeing R. B. Lal Singh safely rejoin me after fully four months of separation. After leaving me in September in the mountains of the Muztagh-ata range he had pushed on and started triangulation of the main K'un-lun range from near Kapa by the middle of October. The work carried on at great elevations and on ground devoid of all resources implied very considerable hardships. But my indefatigable old travel companion faced them with his often proved zeal and succeeded in extending his system of triangles, based on Ram Singh's work of 1906, eastward for over five degrees of longitude before excessive cold and heavy snowfall obliged him to stop it in the mountains. Thus a net with numerous carefully fixed stations and exactly observed angles to many high peaks had been carried well beyond the actual Lop-nor marshes and linked up at the other end with the Indian Trigonometrical Survey. Not satisfied with this achievement, Lal Singh had then continued survey work with the plane-table towards Tun-huang, taking special care to obtain many height observations by mercurial barometer, etc., along his route through those inhospitable snow-covered mountains. After reaching Nan-hu he had struck through the desert north and returned by the track leading along the southern shore of the ancient dried-up salt sea of Lop. The difficulties of this track, the only one through the Lop desert which now, as in Marco Polo's time, is practicable for caravans, were illustrated by the fact that Lal Singh's party found no ice yet formed at the most brackish of the springs along it, and consequently suffered much from the want of drinkable water.

By 15 January 1914 I left Charkhlik for Miran, two marches off to the east, where in 1907 I had made important discoveries among ruins which mark the site of the earliest capital of the "Kingdom of Shan-shan or Lou-lan," corresponding to the present Lop region. Apart from abundant records found in a fort of the Tibetan period I had brought to light in two ruined Buddhist shrines of far earlier date wall paintings of great artistic interest, strikingly reflecting the influence of the Græco-Buddhist art of Gandhara and some almost Hellenistic in character. Owing to the shortness of the time then available for a task presenting exceptional technical difficulties, we had in 1907 been able to remove the frescoes from only one of these temples,

that remarkable series forming the "angel dado" which was exhibited in 1914 in the new galleries of the British Museum together with other selections from my former collection. Of the paintings adorning the walls of the other shrine only specimens could then be safely taken away, and the subsequent attempt made to save the rest was frustrated by the tragic fate which struck my old assistant Naik Ram Singh with blindness at this very place.

I had special reason to regret this when on my renewed visit I found that a portion of the fresco frieze, representing an interesting Buddhist legend, had been broken out by a later visitor in a clumsy fashion which must have caused serious injury if not loss. But the very interesting frescoed dado with its cycle of youthful figures, representing the varied joys of life, set between graceful garland-carrying putti, had fortunately escaped under the cover of sand with which the interior had been filled in as a precautionary measure, and this we now were able to remove intact with all needful care. It proved a delicate task, which greatly taxed the trained skill of Naik Shams Din, my "handy man," and under the icy blasts to which we were almost continually exposed the work was particularly trying. I used the fortnight's stay necessitated by these labours also for a careful search of the adjoining desert belt north, where hidden away amidst tamarisk-covered sand-cones we discovered shattered ruins of two more Buddhist temples of somewhat later date, and secured from them stucco sculptures and other relics of interest.

Simultaneously I had to push on preparations for the explorations which were to take our several parties into the waterless desert north and north-east of the extant Lop-nor. It was some help that the small colony of Lopliks, formerly living at Abdal, whom a slow impulse is gradually turning from semi-nomadic fishermen and hunters into somewhat casual agriculturists, had since 1908 transferred their homesteads to the patches of land now again irrigated from the stream of Miran. But apart from their exceedingly scanty resources and the struggle with their evasive cunning, I had another source of worry to face during those anxious days. Within a week of my arrival at Miran I received a letter from Sir George Macartney bringing serious news. From the headquarters of the provincial Government at Urumchi an edict had issued ordering the district authorities to prevent all surveying work on our part, and in case of any attempt to continue our explorations to arrest and send us under escort to Kashgar "for punishment under treaty." There is neither room nor need here to discuss the probable motives of this intended obstruction, or the alleged regulations by the General Staff of the Chinese Republic quoted in explanation. I knew that the intercession of our Minister at Peking had been immediately invoked from Kashgar by my ever-watchful friend and protector. But that help could make itself felt only after months. In the meantime I should have to contend, if not with an attempt at forcible interference, yet with Chinese passive obstruction easy enough to

apply in my circumstances and particularly dangerous to my plans. Soon there arrived a copy of the edict from the officious Amban at Kara-shahr, whom I had previously asked for a Mongol interpreter. I could gauge the force of the import and language when I saw the sallow face of my poor shrivelled Chinese secretary turning a livid grey as he read through the document and explained it.

Evening after evening as I came back from the day's work at the ruins I looked anxiously among my indolent Lopliks for the first signs of the feared passive resistance to my plans which would have so well suited their natural bent. But fortunately the expected prohibition from Charkhlik never came. As I found out later, I owed this lucky escape to the opportune "revolutionary" outbreak. It had disposed of the original district magistrate before he could take any action. His rebel successor, who had taken charge of the Yamên and found the orders there, had more urgent and profitable business to attend to before he was killed himself. Subsequently the military commandants, in strict observance of Chinese official convention, had carefully abstained from looking into civil affairs, and kept the Yamên papers sealed up until the new Amban had arrived from Urumchi and taken charge of the seal of office. But what a relief it was when I had safely collected all I needed and could set out for the waterless desert where I should know myself completely protected from any risk of human interference! Great as were the difficulties and risks from lifeless nature to be faced there, I was buoyed up by the assurance of freedom for the timely execution of my plans.

On January 23 I had started Lal Singh northward by the Tarim to Tikenlik, where he was to pick up the seven strong camels I had asked Abdur Rahim, the hardy hunter from Singer and our old guide in the Kuruk-tagh, to provide. Thence he was to carry out an exact survey of the ancient river-bed and its branches by which the waters of Konche-darya once reached the area, now wholly desiccated desert, south of the Kuruk-tagh foothills, where Hedin in 1900 had first discovered the ruins of the "Lou-lan" site. The latter was to be our rendezvous. Surveyor Muhammad Yakub Khan, some days later, was sent off with five camels by the desert track to Tun-huang in order to carry a series of exact levelling operations from the eastern end of the great salt-encrusted basin which marks the ancient dried-up Lop sea, towards the termination of the Su-lo Ho drainage.

My own tasks included the excavation of any ruins which the intended exploration of the dried-up delta of the "Kuruk-darya" and the search for the ancient Chinese route once leading eastwards from Lou-lan might reveal. In order to assure adequate time for the latter rather hazardous task and for the survey of the unexplored north and east portions of the great salt-encrusted sea-bed, which, there was reason to assume, that ancient route must have passed through or skirted, it was essential to effect excavations rapidly, and therefore to take along as many

labourers as I could possibly manage to keep supplied with water, *recte* ice. What with big loads of ice sufficient to assure minimum allowances of water for thirty-five people for at least one month, with food supplies of one month for all and of an additional month for my own people, and what with the indispensable outfit of furs, felts, etc., to afford protection in the wintry desert exposed to icy gales, the thirty camels I had succeeded in raising, including our own, were by no means too many. It goes without saying that everybody had to walk, and that the labourers had to help by the carriage of light loads.

It was a great relief when, on February 1, I had safely started this large column for the desert north-eastward. Next day we took up our water-supply in the shape of big blocks of ice packed in bags from a terminal lagoon of the Tarim. Thence four marches brought us to my immediate goal, a large ruined fort (Fig. 12) which had first been sighted by Tokhta Akhun, my faithful old Loplik follower, apparently in 1910, when he returned from the Lou-lan site after guiding there Mr. Tachibana, the young Japanese explorer. By clearing the substantial dwellings within we recovered plentiful relics in the shape of architectural wood-carvings, implements, coins, etc.; these proved occupation to have ceased here about the same period, early in the fourth century A.D., as at the Lou-lan site. Wind-erosion had deeply scoured the ground outside, but had not succeeded in more than breaching in places the very solid enclosing rampart built of alternate layers of brushwood fascines and stamped clay, after the fashion of the ancient Chinese *Limes*. A well-marked dry river-course near the fort was easily traced by the rows of fallen dead trees once lining the banks, and the direction clearly proved it to have been a southern branch of the ancient Kuruk-darya ("the dry river"), which once had carried water to the Lou-lan site.

By following up this river-course we came upon a second and smaller fort, and a reconnaissance north of it soon led to the discovery of the scattered remains of an extensive settlement. The dwellings, built of timber and wattle after the fashion of those at the Niya site, had suffered greatly through the erosive action of wind-driven sand. Yet, where consolidated refuse heaps had helped to protect the original floors, we found ancient records on wood and paper in Kharoshthi and another Indian script, as well as in Chinese and Early Sogdian, besides very interesting and well-preserved remains of furniture, personal equipment, fabrics, and the like. There could be no doubt that this settlement, too, had been occupied down to the beginning of the fourth century A.D., and by people sharing the same well-developed civilization due to the mixture of Indian, Chinese, and Western influences which my finds of 1906 at the Lou-lan site had illustrated.

The exact antiquarian evidence here obtained has its special value, because it enables us to date a variety of physical features which I could observe in the immediate vicinity of the ruined settlement. They throw

fresh light on the hydrography and early occupation of this part of the Lop-nor region during historical times and those immediately preceding them. For the latter the abundant finds of stone implements, such as Neolithic arrow-heads and jade celts, which were picked up from the eroded surface of the ground near these ruins afforded a very useful guide. The fact that these finds of stone implements continued over most of the wind-eroded ground up to the Lou-lan site had a significant bearing on the so-called "Lop-nor problem," the discussion of which has long been carried on without an adequate basis of surveys.

It was similarly important that on the two long marches which brought us there we met a succession of ancient river-beds all lined by rows of dead Toghrak (wild poplar) trees, and clearly recognizable by their direction as having branched off from the "Dry River" skirting the foot of the Kuruk-tagh (Fig. 11). It was plainly a considerable delta, not a large terminal lake, which had existed here during the historical times accessible to antiquarian evidence, and our new surveys have shown how far it extended south and south-west. Finds of Chinese Han coins and of small metal and pottery fragments of undoubtedly the same historical period mingled freely with those of the Stone Age, just on the ground where (according to a recent theory) we ought to have been crossing the position assumed for the Lop-nor of the epoch when Lou-lan was occupied.

It was long after nightfall on February 10 that we struggled through to the old Chinese station marked by the chief ruins of the Lou-lan site. It was very trying ground we had to cross all day, cut up by wind erosion into an unending succession of narrow and steep clay terraces all running east-north-east to west-south-west, the direction of the prevailing wind, and very difficult for the camels to pass. From our base camp at the foot of the familiar Stupa ruin I pushed out reconnaissances into the unknown desert to the east and north-east, while keeping my diggers at work on deeper deposits of refuse, etc., which had escaped attention during the stress of our previous visit. Among the numerous finds of ancient documents on wood and paper which rewarded this clearing, I may specially mention one, unfortunately fragmentary, which shows a script as yet unrepresented among all our former collections. The rest were in Chinese, Kharoshthi, and the Iranian language known since my finds of 1906–07 as Early Sogdian.

Quite as interesting to me were the series of close observations I was able to make on ground immediately adjoining the ruins, as to the levels at which the process of denudation and wind-erosion had been arrested from time to time by a temporary return of moisture and desert vegetation affording protection to the soil. These clearly showed that the process, striking as its effects everywhere are, had been neither constant nor uniform during the sixteen hundred years which have passed since the abandonment of the station. Hence a mere line of levelling carried across areas which wind-erosion has affected in such

different ways, could not, in the absence of dateable marks in the shape of structural or other remains, be expected to yield reliable outlines of the hydrographic configuration of the ground at earlier periods.

But the chance for more exciting work came when I could follow up what the reconnaissance surveys, carried out particularly by Afrazgul Khan, my young Pathan surveyor, with great zeal and intelligence, had revealed towards the north-east. There on ground wholly untouched by human feet for so many centuries, I had hoped to find ruins near what I conjectured to have been the line of the earliest Chinese route leading into the Tarim Basin from Tun-huang and the extreme west of China proper. A succession of important discoveries soon confirmed that hope. On the top of a large clay terrace or Mesha, rising steeply some 35 feet above the eroded ground-level, I came upon most interesting remains of an ancient burial-ground. On the sides of the mound graves had been partially exposed and destroyed by wind-erosion undercutting the banks and causing them to fall. But the top of the Mesha had been safe from this destructive agent, and there we found a series of large grave pits which yielded a rich antiquarian haul in quite bewildering confusion.

Mixed up with human bones and fragments of coffins there emerged here in abundance household implements of all sorts, objects of personal use such as decorated bronze mirrors, wooden models of arms, Chinese records on paper and wood, and, above all, a wonderful variety of fabrics which delighted my eye. Among them were beautifully coloured silks, pieces of rich brocade and embroidery, fragments of fine pile carpets by the side of coarse fabrics in wool and felts. It soon became evident that these remnants of garments of all sorts had been used for wrapping up bodies, perhaps partially embalmed. I could not have wished for a more representative exhibition of that ancient Chinese silk trade which we know to have been a chief factor in opening up this earliest route for China's direct intercourse with Central Asia and the distant West, and which had passed along here for centuries.

A variety of very interesting problems as to the origin of designs, etc., usually attributed to Persian art of the Sassanian period, had been raised by the fine decorated silk fabrics I had discovered on my former journey in the walled-up cave temple of the "Thousand Buddhas" near Tun-huang. Here a mass of far older and dateable materials was coming to light to help to solve those problems. I soon realized from various indications that the contents of these pits must have been collected, before the final abandonment of the Chinese military station of Lou-lan, from older graves which wind-erosion or some similar cause had exposed or was threatening. Consequently the relics here saved, in obedience to a pious custom still prevalent among the Chinese, could safely be assigned to that period of the rule of the Han dynasty which followed the first expansion of Chinese trade and power into Central Asia about the close of the second century B.C. There was no time then to examine the wealth of beautiful

designs and colours making a feast for my eyes. But I felt that in this utter desolation of the wind-eroded clay desert, where nature was wholly dead and even the very soil was being reduced, as it were, to the condition of a skeleton, there had opened up a new and fascinating chapter in the history of textile art. It will take years to read it in full clearness.

My satisfaction was equally great when, after a long and fatiguing tramp from our base, I found myself by nightfall at a large walled enclosure near to where one of the dry river-beds passing the Lou-lan site seemed to merge in the hard salt expanse of an ancient terminal marsh. We had struck the fortified *castrum* which, as close examination soon showed, had served as a *point d'appui* for Chinese missions and troops where they first reached Lou-lan territory after having crossed the salt-encrusted dry lake-bed and skirted its absolutely barren north shores. Its walls, built with regular alternate layers of clay and carefully secured reed fascines, and remarkably well preserved after two thousand years' exposure, showed constructive features in closest agreement with those observed in the westernmost extension of the ancient Chinese border wall which I had discovered and explored in 1907 in the desert of Tun-huang.

There could be no doubt that the fort dated, like the Tun-huang *Limes* itself, from the first military advance of the Chinese into the Tarim Basin, about 104 B.C., and that it represented, as it were, the bridge-head of the desert route by which that advance was made possible. I had become so familiar with that ancient *Limes* and the technical skill displayed in its construction that I could not help rejoicing at the way in which this work from the hands of the same old Chinese engineers had withstood the attacks of that most formidable enemy in this region, wind-erosion. The walls of reed fascines had nowhere been seriously breached, while inside the circumvallation the force of the wind has worked terrible havoc, scouring out big hollows down to 20 feet and more below the ground-level and reducing a large central structure to a bare clay terrace strewn with scattered débris of timber. Under the shelter of the north wall, however, refuse heaps had survived, and these yielded Chinese records on wood and paper.

Beyond this fortified Chinese station other remains were traced. Of these it must suffice to mention a small ruined fort which occupied a commanding position on the narrow top of a precipitous clay ridge fully 100 feet high (Fig. 14). It had evidently served as a stronghold and look-out post for some chief of the indigenous population of Lou-lan. Of the type, habits, and civilization of the Lou-lan people as the Chinese found them on the first opening of the route through the desert, the Han Annals have preserved some curious notes. The accuracy of these was illustrated in a most striking fashion by the examination of the graves covering the other end of the clay ridge. Here we found the bodies of men and women, probably members of the old chief's family, in a truly wonderful state of preservation, due, no doubt, to the absolute dryness of the climate and the safe elevation

of their resting-places. The peaked felt caps of the men decorated with big feathers and other trophies of the chase, the arrow-shafts by their side, the simple but strong woollen garments fastened with pins of hard wood, the neatly woven small baskets holding the food for the dead, etc., all indicated a race of semi-nomadic hunters and herdsmen, just as the Chinese describe them.

It was a strange sensation to look down on figures which but for the parched skin seemed like those of men asleep, and to feel brought face to face with people who inhabited, and no doubt liked, this dreary Lop-nor region in the first centuries A.D. The features of the heads closely recalled the *Homo alpinus* type, which, judging from my anthropometric records, worked up by Mr. T. A. Joyce, still supplies the prevalent element in the racial constitution of the indigenous population of Chinese Turkestan and is seen in its purest form in the Iranian-speaking tribes near the Pamirs. The general appearance of these Lou-lan people seemed curiously to accord with the significant juxtaposition in which small bronze objects of Chinese origin were picked up on the slope below the little fort together with stone implements. There were indications elsewhere, too, suggesting that the interval separating the latest Neolithic period in Lou-lan from the advent of the Chinese may not have been a very long one.

Apart from their direct interest, the discoveries here briefly indicated had a special importance by furnishing me with a safe starting-point and some guidance for the difficult task still before us, that of tracing the line of that famous ancient route through the forbidding desert eastwards. But it was impossible to set out for it at once. Incessant toil in the waterless desert with constant exposure to its icy winds had exhausted our Loplik labourers, hardy plants as they were and pleased with the rewards I gave them. When the last digging at the outlying ruins to the north-east had been done, I had to take them back to our Lou-lan base camp, whence they could return in safety under Ibrahim Beg's guidance to the world of the living.

The season's initial sand-storm, which had broken with full fury on the preceding night and which the Lopliks attributed to the wrath of the dead we had disturbed, made this march exceptionally trying, apart from the risks of straying which the semi-darkness involved for the men. To my great relief I found Lal Singh safely arrived after accomplishing his survey tasks in the west on a circuit of some 400 miles. He had been duly joined by that plucky hunter, Abdur Rahim, who with his life-long desert experience and his magnificent camels brought fresh strength for our column. It may serve to illustrate the stamina of his animals, bred and reared in the Kuruk-tagh, that the baby camel to which one of them gave birth at the Lou-lan site subsequently traversed with us all those waterless wastes of salt and gravel unharmed and almost throughout on its own legs.

Together we then moved north to the Kuruk-tagh in order to secure

for our hard-tried camels a few days' rest with water and grazing at the salt springs of Altmish-bulak. The new route followed on the three days' march allowed me to examine more burial-grounds on the gravel glacis which overlooks the ancient riverine belt, now dried up and eroded by the wind. Their remains proved very helpful for explaining my previous finds east of the Lou-lan site. But even more welcome was the four days' halt at Altmish-bulak. Its springs, saline as they are, gave our brave camels their first chance of a real drink after three weeks, and on the reed beds around them they could gather fresh strength for the hard task still before them. After the dead world we had toiled in, this little patch of vegetation seemed delightful, too, to us humans.

After replenishing our ice supply and taking a carefully arranged store of fuel, we started on February 24 for our respective tasks. The one allotted to Lal Singh was to survey the unknown north-east shores of the great salt-encrusted basin, which represents the fullest extension of the dried-up ancient Lop-nor, and the barren hill ranges of the Kuruk-tagh overlooking them. I myself, accompanied by Afrazgul and Shams Din, proposed to search for the ancient Chinese route where it left the edge of the once inhabited Lou-lan area, and to trace it over whatever ground it might have crossed, right through to where it was likely to have diverged from the line still followed by the desert track, which leads from Tun-huang along the southern shore of the great dried-up Lop sea towards Miran. It was a fascinating task after my own taste, combining geographical and historical interest, but one attended also by serious difficulties and risks.

From what I knew of the general character of the ground before us, it was certain that we could not hope for water, nor over most of it for fuel to melt our ice with, before striking the Tun-huang caravan track, a matter of some ten days' hard marching judging from the approximately calculated distance. There was a limit to the endurance of our brave camels, and with the heavy loads of ice, fuel, and provisions which had to be carried for the sake of safety, I could not expect the animals, already hard tried by the preceding weeks' work in absolute desert, to remain fit for more than ten to twelve days. It was impossible to foresee what physical obstacles might be met and might delay us beyond the calculated measure of time in this wilderness devoid of all resources and now more barren, perhaps, than any similarly large area of this globe. There remained the problem how to hit the line of the ancient route and to track it through on ground which long before the dawn of historical times had ceased to offer any chance for human occupation. For a careful search of any relics left behind by the ancient traffic, which had passed through what the Chinese Annals vaguely describe as the terrible "desert of the White Dragon Mounds," there would be no time. Much, if not most, had to be left to good fortune—and, combined with what hints I could deduce from previous archæological and topographical observations, Fortune served me better than I had ventured to hope.

Physical difficulties soon presented themselves as we made our way south through and across a perfect maze of steep clay terraces all eroded by the same east-north-east wind which had sculptured the usual 'Yardangs' of Lou-lan, but of far greater height. Having thus regained the vicinity of the terminal *point d'appui* above mentioned of the ancient route, I soon found confirmation for my previously formed conjecture that the initial bearing of the route lay to the north-east. It was marked by the almost completely eroded remains of an outlying indigenous camping-place and of an ancient watch-tower of the type familiar to me from the Tun-huang *Limes*, which I opportunely discovered on towering terraces at the very edge of ancient vegetation. We had reached here the extreme eastern limit of the area to which the waters of the Kuruk-darya had once carried life. Beyond there were no ruins to guide us. The desert eastwards was even in ancient times as devoid of plant or animal life of any sort as it now is. As we left behind the withered and bleached fragments of the last dead tamarisk trunk lying on the salt soil, I felt that we had passed from the land of the dead into ground that never knew life—except on the route to be tracked.

As we steered onwards by the compass across absolutely barren wastes of clayey *shōr*, detritus or hard salt crust, chance helped us in a way which at times seemed almost uncanny. Again and again finds of early Chinese copper coins, small metal objects, stone ornaments and the like gave assurance that we were still near the ancient track by which Chinese political missions, troops and traders, had toiled for four centuries through this lifeless wilderness. It is impossible to record here exact details of all such finds. But I may at least briefly mention two thrilling incidents which by their nature helped greatly to raise the spirits of my men and filled them with superstitious confidence in some spirits' safe guidance. At the time they made me too feel as if I were living through in reality experiences dimly remembered from some of Jules Verne's fascinating stories I had read as a small boy.

Thus, on the third day of our march, when the last traces of ancient desert vegetation had long remained behind, we suddenly found the ancient track plainly marked for about 30 yards by over two hundred Chinese copper coins strewing the dismal ground of salt-encrusted clay. They lay in a well-defined line running north-east to south-west, just as if some kindly spirit among those patient old Chinese wayfarers, who had faced this awful route with its hardships and perils, had wished to assure us that the bearing I was steering by was the right one. In reality they must have got loose from the string which tied them and gradually dropped out unobserved through an opening in their bag or case. The coins were all of the Han type, and seemed as if fresh from some mint. Some 50 yards further on in the same direction we came upon a similar scattered heap of bronze arrow-heads, all manifestly unused and looking as if newly issued from some arsenal of Han times. Their shape and weight

exactly agreed with the ancient Han ammunition I had picked up so often along the *Limes* of Tun-huang, which was garrisoned during the first century before and after Christ. The way in which the coins and arrow-heads had been allowed to remain on the ground suggested that they had dropped from some convoy of stores in Han times which was moving at night-time, and probably a little off the main track but still in the right direction.

Next day's long march brought another discovery equally stirring and useful. We had followed our north-easterly course across easy ground of bare clay and mica detritus when it approached at a slant a forbidding belt of salt-coated erosion terraces, clearly of the type to which the Chinese of Han times had applied the graphic designation of "White Dragon Mounds." I knew it foreboded the close vicinity of that ancient sea-bed encrusted with hard crumpled salt which I was anxious to steer clear of as long as possible, on account of the terrible surface it would present for our poor camels' feet. They were sore already, and the painful process of "re-soling" (by pieces of ox-hide sewn on to the live skin) had to be resorted to night after night. I was just preparing to climb the prominent Mesha which had served as our guiding point, and to use it as a look-out, when we found on its slopes Chinese coins, soon followed by quite a collection of metal objects, including bronze ornaments and a well-preserved dagger and bridle in iron. Evidently the terrace had served as a regular halting-place, and a careful inspection of the ground ahead suggested that it had been used for this purpose, because at its foot was the first piece of ground level and tolerably clear of salt which travellers would strike after passing through the forbidding maze of "White Dragon Mounds" and the dried-up sea-bottom beyond.

I had to decide whether I was to strike across the latter now or to skirt the ancient seashore by continuing the north-east course, which threatened to take us further and further away from where we hoped to find water. It might have meant a détour of days, and the interpretation I put on our lucky find encouraged me to avoid this by heading straight for the dead salt sea. That evening we had reached its shore-line, and the crossing effected next day proved how wise the change of direction had been. The march across the petrified sea, with its hard salt crust crumpled up into knife-like small pressure ridges, was a most trying experience for camels and us men alike. But when this weary tramp of 20 miles, more fatiguing than any I ever had in the desert, had safely brought us to the first spot of soft salt in front of the opposite line of salt-covered erosion terraces, and we could halt for a night's rest, I had good reason to feel glad for my choice and grateful for the find which had prompted it. As the following marches proved, we had crossed the forbidding sea of hard crumpled salt at the very point where it was narrowest, and had thus escaped a night's halt on ground where neither beast nor man could have found a spot to rest in comfort. It was, no doubt, this

FIG. 13.—CLAY TERRACES MARKING SHORE-LINE TOWARDS EASTERN END OF ANCIENT LOP SEA-BED.

FIG. 14.—WIND-ERODED CLAY RIDGE NORTH-EAST OF LOU-LAN SITE, BEARING REMAINS OF ANCIENT FORT.

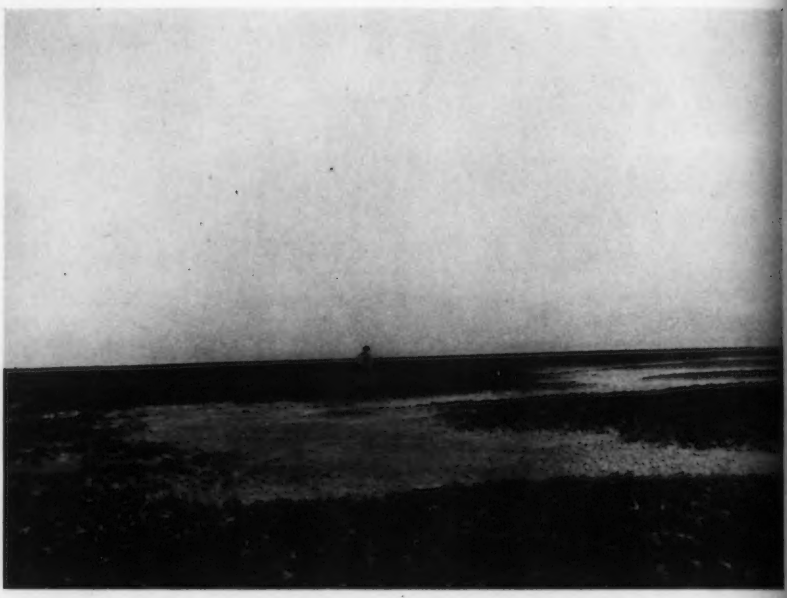

FIG. 15.—ANCIENT SALT-ENCRUSTED LAKE-BED NORTH OF KUM-KUDUK.
Patch of actual salt bog shows up white.

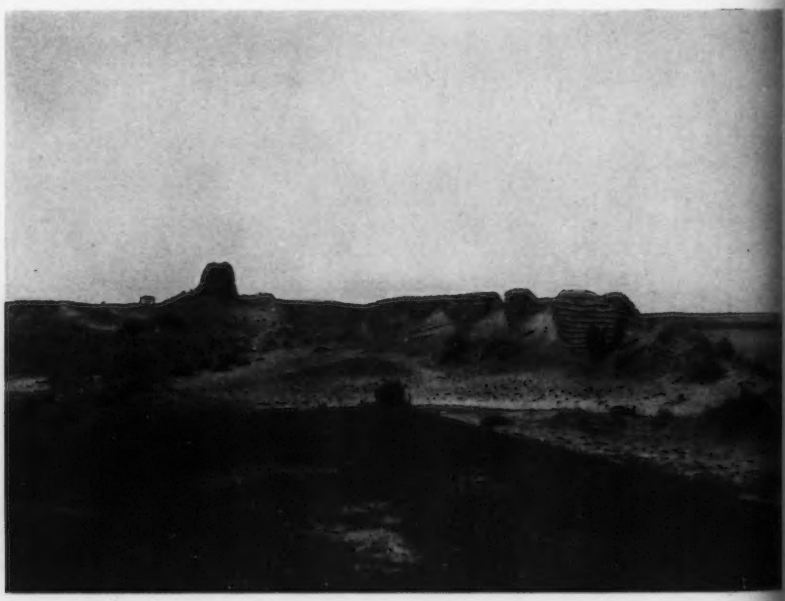

FIG. 16.—RUINED WATCH-STATION ON ANCIENT CHINESE FRONTIER WALL, WEST OF TUN-HUANG.
The projecting horizontal lines in wall on right mark layers of reed fascines.

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advantage which had determined those old Chinese pioneers in the choice of this line for their route.

Helped by finds of coins and the like, we continued to track the route over ground still absolutely barren, until we reached, three days later, the last offshoot of the low desert range which overlooks from the north the extreme eastern extension of the ancient dried-up sea-bed. Then, as we skirted its shore-line under steep cliffs looking exactly like those of a sea still in being (Fig. 13), I had the satisfaction of finding the ancient track in places still plainly marked in the salt-encrusted ground. It was a strange sensation when my eyes first caught the straight line of the ancient road, where it cuts for nearly two miles across a small bay of the petrified sea. It showed a uniform width of some 20 feet, and was worn down to a depth of about one foot in the surface of hard salt cakes, as a result of the passage for centuries of transport animals, and probably carts too. There was ocular evidence here of the magnitude of the traffic which had once moved through these barren solitudes. But how those patient old Chinese organizers of transport had maintained it over some 150 miles of ground without water, fuel, or grazing still remains somewhat of a problem.

It was a great relief when by the ninth day from Altmish-bulak we came upon the first scanty scrub and reeds growing on sandy soil by the shore of the ancient dried-up sea. Next day a long march to the south-east brought us safely across the wide, salt-encrusted expanse, here showing patches of actual salt bog (Fig. 15), to the lonely caravan track towards Tun-huang. There at the well of Kum-kuduk I had the great satisfaction of finding brave Lal Singh just arrived after carrying out an interesting survey of the north-eastern shores of the dried-up sea-bed and of the straggling low ranges which abut upon them. One day later our successfully arranged concentration was completed by the arrival of our heavy baggage from Miran.

Letting it move on towards Tun-huang by the caravan track we turned once more north across the end of the dried-up Lop sea, and continued to explore the ground close to the foot of the Kuruk-tagh where the ancient route had passed. Further to the north-east the desert area near the present terminal basin of the Su-lo Ho River, with its dried-up depressions and mazes of lacustrine Meshas, offered opportunities for geographically interesting new surveys. There I picked up Surveyor Muhammad Yakub Khan, who had carried a carefully observed line of levels all the way up from the southern shore of the ancient dry sea. Coupled with other observations, its result has confirmed my belief that the waters of the Su-lo Ho at a period relatively recent in a geological sense had drained into the Lop-nor Basin. We found them still percolating in the same direction the sandy soil at the foot of the Kuruk-tagh, within a few feet from the surface. Evidence that this drainage had been more considerable during historical times was furnished by the remains we traced of a canal, which appears to have been constructed for

the purpose of carrying water along a portion of the ancient Chinese route where it approached the eastern end of the dried-up salt sea.

Leaving the surveyors behind for supplementary tasks, I reached by March 16 the westernmost point of that fortified ancient Chinese border line which I had first discovered and successfully explored in 1907. It was a cheering experience for me during the next few days to revisit the ruined watch-stations of the "Great Wall" in this desolate gravel waste, and clear up on the spot antiquarian questions raised by the ancient records they had yielded. I felt quite at home here as I followed again the tracks still clearly visible for long distances which the tramp of the patrols marching along the wall for centuries had worn into the soil. The fact that in places I could quite distinctly recognize my own footprints of seven years before, and those of my little dog, was the best illustration how long this bare gravel surface might retain traces of regular tracks even if trodden about the time of Christ. From Lake Khara-nor onwards I then completed my detailed exploration of the Tun-huang *Limes* by searching all the ruined watch-towers along a portion of the line where circumstances had in 1907 obliged me to leave a gap in my survey (Fig. 16). These small watch-stations usually occupied the top of high erosion terraces, and their ruins and refuse heaps were thus well protected from damp. So our search was rewarded by plentiful finds of Chinese records on wood, curious articles of equipment and other interesting relics going back to Han times.

(The remainder of the paper, with Map, will be published in the September number of the Journal.)

NOTES ON THE GEOGRAPHY OF IMBROS.

Alan G. Ogilvie.

THE following notes are presented for what they are worth, partly because no geographical account of this Ægean island exists, so far as I know, and partly as an indication of the directions in which Imbros offers a field for profitable scientific investigation. The notes are necessarily based on somewhat superficial observations made in about one-quarter of the total area—observations practically confined to the few afternoon walks which my military duties connected with the operations on Gallipoli allowed me. They were made at intervals between August 1915 and January 1916.

No accurate topographical map of Imbros exists. Only a very sketchy idea of the relief and river system can be gained from the best published map—1 : 250,000 War Office, London. Imbros is shown geologically coloured on the International Geological Map. But this should not be accepted.

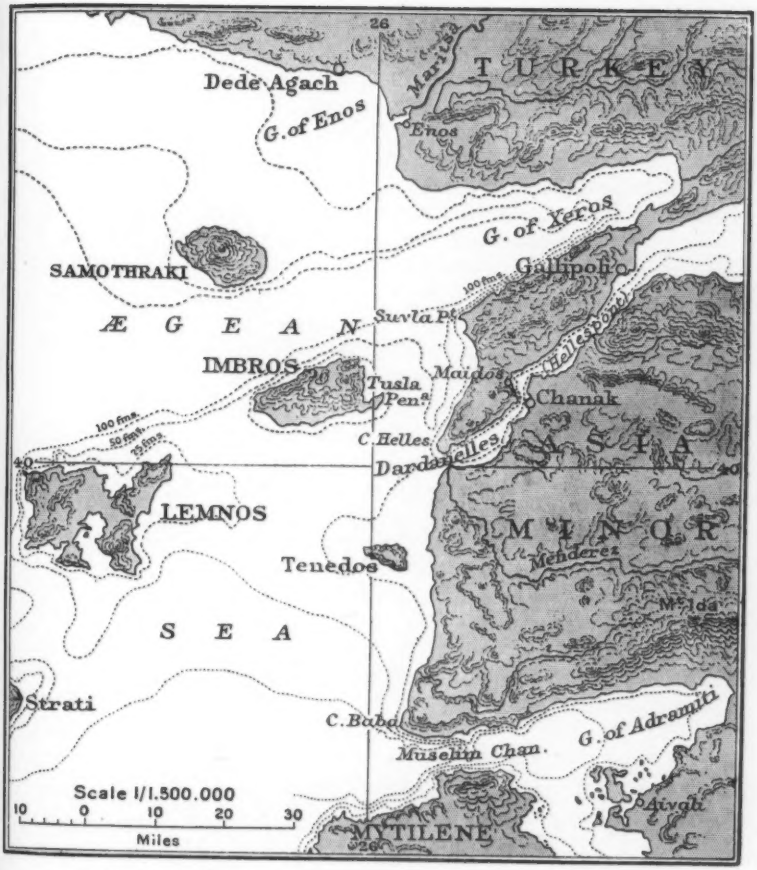


FIG. 1.—SKETCH-MAP TO SHOW THE POSITION OF IMBROS.

Situation and Extent.—The trough of deep water which extends west-south-west from the Gulf of Xeros has a series of three land masses for its southern wall, viz. Gallipoli as far as Suvla Point, Imbros and Lemnos. The northern coast of these three form roughly a straight line, and the water-gaps, Suvla-Imbros and Imbros-Lemnos respectively, are 15 and 13 miles. Across the trough from Imbros and 16 miles from it rises the steep, high wall of Samothraki (see Fig. 1).

Imbros at its longest and widest is 17 by 9 miles, and has an area of about 100 square miles. Its north-west and south-east sides are parallel to each other, to the axis of the Xeros trough and to the opposite coast of Samothraki, and we shall see that the grain of the relief also follows this trend. It is thus apparent, even at first sight, that the topography of the island and the tectonics of the region are closely related.

Composition.—Imbros is composed mainly of rocks of volcanic origin and chiefly of the acid order, but there are also important outcrops of sedimentary strata. Probably the greatest area is covered by andesites—for the most part much decomposed—and rhyolites, interbedded with acid agglomerates, tuffs and ash-beds. Basic rocks also crop out in places, basalts, or dolerites, occurring as flows, and perhaps as necks. I have also seen small dykes of gabbro. The sedimentary rocks seem to fall into two categories—those interbedded with the volcanics, and those on the fringe of the island. The first consist of (*a*) silicious beds ranging from conglomerates to sands, the pebbles being mainly derived from granitic or gneissic rocks; and (*b*) finely laminated shales (bearing plant remains) with red and green clays. The second class are sandstones and clays with many concretions. They are apparently isolated residual patches of the strata occurring on both sides of the Dardanelles.

Structure and Relief.—Imbros, so far as I have seen, is an area of rocks of great variability of strength, which forms part of a steeply folded anticline with its axis parallel to the length of the existing island. The bulk of the surface is the deeply ribbed outcrop of this anticline unroofed by denudation, while another large area, the south-east, is occupied by bedded and gently tilted volcanic rocks subsequently laid down over part of the denuded anticline (see Figs. 2 and 3).

The whole is now a maturely eroded surface, except (*a*) on the highest ridges, where youthful mountain forms persist, and (*b*) where renewed youthful surfaces have been cut. These give evidence of a fresh cycle of erosion initiated by uplift of the land, and perhaps also by the foundering of the marginal belts.

The essential features in the structure of the eastern half of Imbros (of which alone I can speak) seem to be these. The strike of the rocks is generally parallel to the length of the island. The shales and clays dip at steep angles to the south-south-east, and the two main outcrops of these beds in the big *subsequent* furrows are separated by a continuous chain of rocky domes and pinnacles of igneous origin, which may be (*a*) interbedded

lavas dipping very steeply to the south-south-east, or (*b*) a line of volcanic necks or intrusions, and some of them at least have all the appearance of "plugs."

In the central section of the island this range forms the main water-parting. To north and south of it lie the fertile basins cut in the weaker sediments, which in their turn are scored by small hogback ridges formed by the stronger beds. The northern coast is dominated by the highest ridge of Imbros. In its central portion the volcanic strata, as seen from a distance, seem to be nearly vertical, and they display some of the forms characteristic of the more steeply folded parts of the Jura Mountains. This ridge has at least one important breach at sea-level, which forms the chief gateway to the island.

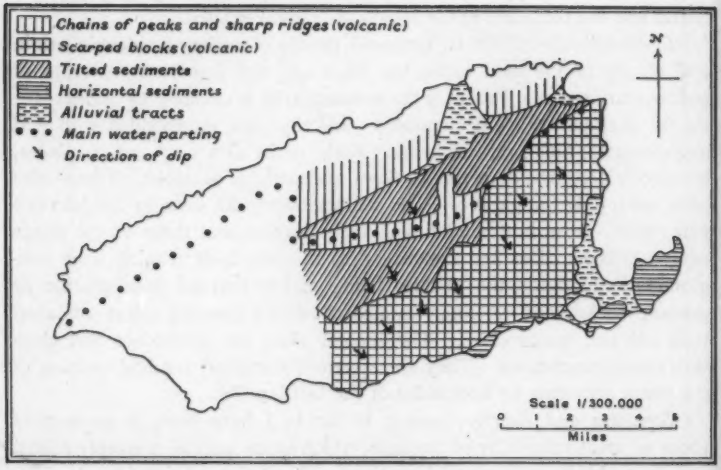


FIG. 2.—SKETCH-MAP OF IMBROS, SHOWING MAIN PHYSIOGRAPHICAL DIVISIONS.

Fronting all this area of steeply inclined rocks with their resulting topography characteristic of great variability of outcrop, there is a bold and continuous escarpment. This is the front edge of another physiographical region—the area of scarped hill-blocks of volcanic rocks, scored by deep narrow valleys, which occupies most of south-east Imbros. The rocks lie unconformably upon the sediments above mentioned, and they dip gently, for the most part south-eastward. They include flows of andesite, now much decomposed and displaying brilliant hues—reds, purples, and white, and interbedded with these are coarse agglomerates of great thickness and thinner beds of tuff and ash.

At the east end of the island the front escarpment of this area forms the main divide, and it is here broken only by high passes. Further west it swings more to the south and is pierced at several points by rivers

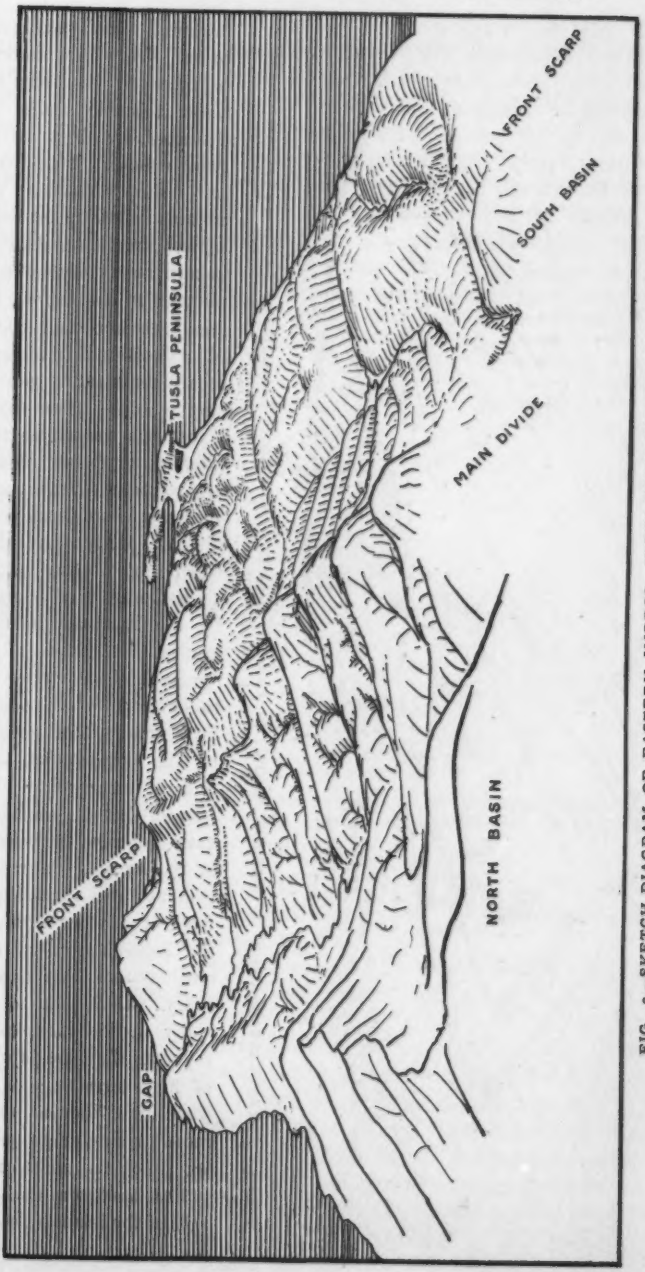


FIG. 3.—SKETCH-DIAGRAM OF EASTERN IMBROS; VIEW TOWARDS EAST-SOUTH-EAST.

FIG. 4.—NORTH-EAST CORNER OF IMBROS SHOWING EFFECT OF REJUVENATION; SAMOTHRAKI AND THRACIAN COAST IN THE BACKGROUND.

draining the southern basin. The whole district occupied by these gently-tilted volcanic rocks is dissected by deep *consequent* valleys. There are also short reaches of streams following the *subsequent* direction, and these in turn have *obsequent* tributaries, so that the whole area is cut into steep-sided blocks, all having abrupt escarpments and gently sloping tops. Seen from a distance the slopes appear smooth, but closer acquaintance reveals many very rugged surfaces produced partly by the weathering of the coarse agglomerates and partly by the irregular disintegration of the lavas.

So far I have referred to no feature which cannot be accounted for simply by the composition and internal structure of the island. But the detailed examination of the valleys in the scarped ridge district at once reveals the work of another agent—the rejuvenation of the river system. In nearly every valley, and especially in the main consequents, there are patches of high terrace; and in some the evidence is still more striking (Figs. 4 and 5). Let us consider a typical case from the east side of the island (Fig. 5).

This valley, which has its head in a wide saddle in the main escarpment, is made up of three distinct reaches. The upper third is wide and smoothly rounded like the saddle at its head, but trenched by the stream, which buries itself ever deeper in the floor as it descends, and then plunges in a narrow slot-shaped gorge through the wide step that overlooks the second reach. This is a typical V-shaped valley with high, steep sides. The headward erosion of the stream has removed all trace of the old higher valley floor, except for a few patches of terrace left clinging high up on its sides. There is little or no alluvial belt, but the soil creeping under the influence of gravity has accumulated on the lower slopes, and provides enough ground for tillage and orchards on a small scale. This

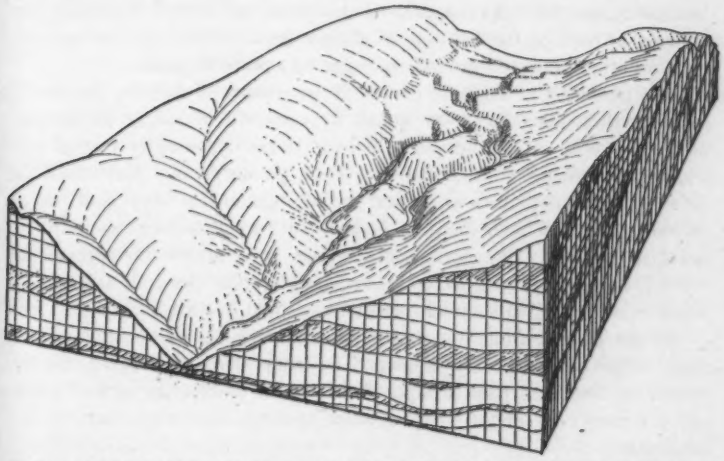


FIG. 5.—BLOCK-DIAGRAM OF UPPER PORTION OF A CONSEQUENT VALLEY IN EASTERN IMBROS, SHOWING HIGH TERRACE AND EFFECT OF REJUVENATION.

narrow middle reach ends at the margin of the hills; and the last third is the winding course of the stream over a wide delta which is now undergoing the process of dissection by the stream itself.

The effects of this rejuvenation of the streams is seen in nearly every valley of eastern Imbros, and one naturally looks along the coastline for signs of elevation of the land. Nor are these wanting. Patches of raised beach at various elevations and dissected deltas at the mouth of nearly every stream are to be seen. The highest of the beaches on the south coast seems to be about 110 feet, while an occasional delta apex is still higher. It seems natural to associate this high beach with the wide valleys such as I have described as near the watershed. But careful levelling will be necessary to show if these wide valleys and high terraces were cut by rivers which had their mouths some 100 feet higher than the present sea-

level, and therefore presumably had shorter courses. Moreover it is noticeable that the high beach is seldom backed by a marked cliff, showing that the sea could not have remained long at that level. I would suggest another possibility, namely, that the lowest or seaward parts of the high valleys have been removed as a whole by the foundering of the land over which they flowed. Such a hypothesis seems reasonable in view of the known origin of the Ægean basins by foundering.

The higher coastal terraces are composed mainly of boulders and large pebbles, but the lowest, which is from 5 to 10 feet in elevation, is in many parts of dark-coloured clay. The wider patches of this terrace probably represent recently elevated lagoon bottoms. At its present level the sea has already accomplished a good deal in the initial nipping of the headlands, and the material derived therefrom has served to smooth out the smaller bays by the building of shingle bars. These enclose lagoons, or more often the damp ground representing a drained lagoon.

The peninsula of Tusla at the south-east corner of Imbros, like some other patches along the south coast, is composed of yellow sandstones and clays more or less horizontally bedded and apparently resting unconformably on the volcanic rocks. Tusla peninsula is a *tied island*, or rather it consists of two islets, first linked together by wind- and wave-driven sand, and then tied to Imbros by two sand-bars enclosing a brackish lagoon. The north-east sand-bar, lying athwart the prevailing wind, is now greatly widened by blown sand, and the life of the salt lake—which is nearly dry in summer—can be measured in decades.

Before passing from the subject of relief, the relative heights of the main ridges should be mentioned. The steep northern ridge is mostly over 1500 feet, and rises abruptly from the sea; while the central ridge and the front edge of the scarped block area are over 1000 feet for the most part.

Climate.—The position of Imbros renders its climate specially interesting and worthy of investigation. I must content myself with giving one or two reasons for this, since a temporary resident and superficial observer (*i.e.* one who has not kept records) should not attempt to describe a local climate except in its most striking aspects. Moreover, in this case a competent observer has kept records in his official capacity during the period of my residence, and his results will doubtless be given to us in due course.

Imbros is on the extreme northern fringe of the Eastern Mediterranean, and is therefore to some extent subject to the climatic features of that basin. These are chiefly a hot, dry summer, and a mild winter characterized by the passage of frequent rain-bearing cyclonic storms. To the south-west, then, the island is open to the Mediterranean influence; to the north-east it is open to the Black Sea influence; and it must be remembered that behind the Black Sea and without a barrier is that reservoir of winter cold—lowland Russia. Imbros is flanked to north-west and south-

east by highland masses—the Balkan Peninsula and Anatolia. Now if the position of Imbros be borne in mind, and the following broad facts be considered, the main features of the climate will be easily understood.

In summer South Russia with the Black Sea forms a reservoir of relatively cool air and high pressure. This air is constantly travelling outward anti-clockwise, and tends to enter Anatolia, and still more is drawn towards the centre of greater attraction—the low-pressure areas of Arabia and North India. A steady breeze, and sometimes a strong wind, therefore passes from the Black Sea over Imbros to the Ægean and Eastern Mediterranean. This air, ever getting warmer, is dry. The only exception to this is caused by an occasional local depression which finds its way to South Russia and Rumania, or which forms there, and may draw air from the south-west over Imbros. But the only summer rains on the island seem to be the accompaniment of thunderstorms.

In winter the conditions are quite otherwise. The Mediterranean, Ægean, and Black Seas form a relatively warm belt—a trough of low pressure. They become the track of low-pressure centres moving generally from west to east. Russia, on the other hand, with its cold winter atmosphere, provides a more or less permanent area of high pressure with a strong outward circulation of air on its fringes. The Balkan Peninsula and Anatolia, being colder than the sea, tend to form smaller centres of high pressure over them.

The winter climate of Imbros, therefore, has as its outstanding features: First, the temperature and wind conditions produced on the southern fringe of a cold anticyclonic region; and, secondly, the passage of successive cyclonic disturbances from the Ægean to the Black Sea. Now, as the distribution of land and sea regulates the atmospheric pressure, the cyclones of this region are much elongated in a south-west to north-east direction (this fact and its consequences have been pointed out to me by the official meteorologist, Captain E. M. Wedderburn). The common weather sequence resulting from the passage of one of these depressions is as follows: A south to south-west wind springs up while the centre is still west of Imbros. This wind, which may bring rain and sometimes brings a deluge, lasts until the low centre is over Imbros, when a calm ensues. The calm, however, generally lasts for less than a day, as the area of minimum pressure is so narrow and soon passed. Then quite suddenly the temperature falls, and the north to north-east wind springs up and often rises quickly to a gale. This wind, blowing in on the back of the depression, brings air from the high-pressure reservoir of the cold Russian steppes, and from the Balkans and Rhodope highlands. The physiological effect of this wind—so dreaded by ancients and moderns alike—is the greater owing to the moisture which it sometimes carries. The moist or dry condition of the wind seems to depend to a great extent on its route—over the Black Sea or over the Balkans. Whether moisture is deposited on Imbros or not probably depends on the rapidity with which the air is rising in the cyclone at that

point. However that may be, the fact remains that the winter north-east wind on Imbros is very frequently a wet wind. Another of its striking characteristics is the suddenness with which it springs up. The cause of this seems to me to merit investigation. In the absence of a better explanation I would suggest as a possibility that the air, coming inwards to the low centre, sweeps upwards in its spiral rise at a steeper angle than is the case in our British cyclones. Why this should be I cannot say. But the effect at the ground level would be to eliminate to some extent the zone of light wind between the calm centre and the strong wind-zone on the back of the depression.

It is unfortunately impossible to say what is the mean annual rainfall of Imbros. It probably lies somewhere between the 29 inches of Constantinople and the 17 inches of Salonika—say about 23 or 24 inches. The scantiness and the xerophilous character of the natural vegetation, as well as the absence of water from all streams in summer, point to a low annual rainfall. At any rate, it is mainly a late winter or early spring rainfall.

Water Supply.—The conditions affecting the quantity of water available for vegetation and agriculture are, of course, those of rainfall and evaporation, and of porosity and inclination of rocks. Now the winter and spring rains are succeeded on Imbros by three or four months of intense dryness and strong evaporation. It is therefore obvious that on such a small island no water will remain on the surface throughout the summer.

As to the water which may remain stored in the rocks let us recall the structure of the island. Generally speaking, there are very few really porous rocks in Eastern Imbros. The agglomerates and ash-beds seem to be practically impermeable; while the andesites are not well jointed and are decomposed over large tracts almost to a purple clay. Probably the most porous are the sandstone beds in the sediments, and even these have a good deal of clay with them. It would seem, then, that little water sinks in; but in any case if it did a glance at a section [the section was unfortunately not included in the material received from the author. But see Figs. 2 and 3] will show that all water sinking into the south basin will percolate southward and will not again appear on the island. Only the water which falls on the hills to the south may be recoverable in the sandstones or alluvial beds of the south coast.

In short, the water used in agriculture and absorbed by vegetation is chiefly surface water, and virtually the only permanent supply of drinking water is from wells sunk in the alluvial deposits in valleys, deltas, and raised beaches, with an occasional hillside spring due to some irregularity of rock structure.

Vegetation.—The task before the botanist on Imbros should be an interesting one, for an island with its situation is likely to have a composite flora, with components from the Mediterranean region and from Central and Eastern Europe.

The vegetation of Imbros, as distinct from the flora, is in the main of Mediterranean type; the island is naturally scrub-covered, and the scrub is mainly xerophilous; hardly anywhere on the slopes is there a continuous covering of humus, and there is much bare rock. Here and there, however, a group of more or less stunted oaks—the sessile oak—acts as a reminder that at no great distance are the deciduous forests of the Balkan Peninsula. Or, again, in the valley bottoms a tangle of brambles and bracken takes the northerner back to his homeland. But the impression is invariably dispelled by the bright green and—in summer—the brilliant pink of the oleanders, which line every stream-bank.

Though forest trees are few on Imbros, there is considerable variety in the natural vegetation, and in parts the numerous orchards and olive and poplar groves give the land a well-clothed appearance.

The variation in natural vegetation, *i.e.* chiefly in types of scrub, seems to depend chiefly on the amount of moisture available, and perhaps to a lesser extent also upon the edaphic or soil conditions and degree of exposure to wind. The most striking feature is the contrast between the barren monotony of the southern slopes of the scarped block district, with the comparatively rich verdure of the interior basins. The former area is almost entirely covered by a highly xerophilous thorn bush, *Poterium spinosum*. This bush, with its long yellow spines and tiny dark green leaves, gives the hills a uniform khaki tint—so much so that the British service dress might have been designed on Imbros. Associated with the thorn is a grey-green sage bush bearing a small violet flower. The winter and spring dress of this area is somewhat brightened by the appearance with the first rains of a short turf of bright green grass mixed with lichen wherever a little soil has accumulated, and by the green shoots from the many bulbs which lie in similar situations.

The cause of the aridity of the southern slope lies, of course, in the exposures and the lack of springs. Only on the valley sides is the monotony broken by the deeper shade of the evergreen oak bushes, with their small shiny and prickly leaves.

In great contrast to this is the varied scrub of the moister places, and especially of the two interior basins corresponding to the outcrops of the sediments. More particularly in the shady hollows of the north slope of the central ridge the bushes are from 5 to 8 feet high. But their height decreases rapidly near the wind-swept crest-line, and eventually at the top they are mere creeping shrubs. With the exception of an occasional oak the species are nearly all evergreen, but of every shade of green. The dominant shrubs are juniper, arbutus, several heaths, prickly oak, wild olive, and a privet; together with several species with small leathery leaves which I could not identify. Here and there is a ground formation of rock rose and butcher's broom.

The only two trees which appear in any quantity with their natural distribution are the two oaks already referred to; the groups of deciduous

(sessile) oaks, which are found in the more sheltered spots reaching well over the 1000-foot line, have all the appearance of the relics of a once widespread forest. The evergreen oak occurs mainly as an isolated tree, never more than 30 feet high. But I think these are merely the specimens which survive the constant nibbling of the young shoots by goats; and were it not for the goats, the evergreen oak would form extensive low woods instead of merely a stunted scrub.

The number and probably the variety of cultivated trees exceeds those in natural situations. The olive is widely spread in most of the lower land. The bulk of the streams and even many hillside streams have their Lombardy poplars, and there are numerous orchards of prickly damson and of fig trees. In some of the alluvial land the latter attain great size; in the northern basin I saw a fine hemispherical tree 40 feet high. Imbros can probably be regarded as quite suitable to both the olive and the fig, but I have no information as to the yield. The former is cultivated up to over the 900-foot line, and isolated trees are found even higher, while self-sown fig trees, albeit somewhat stunted, flourish among the crags of wind-swept hilltops even higher than that. The presence of the olive shows clearly that Imbros cannot be subject to long and severe frosts. But I have seen the effect on them of a short spell of severe weather, viz. a two-day northerly blizzard with a temperature just below freezing, followed by a calm night with 10 degrees of frost (Fahr.). The olives shrivelled their leaves a little, but quickly recovered.

Trees of all kinds, in all but the most sheltered valleys, are bent towards the south or south-west, thus testifying to the prevalence of northerly winds.

Fauna.—The fauna of Imbros is probably not large. The only four-footed creatures which I have seen are a hare, a squirrel, a toad, and a small lizard. There are also ringed snakes, which attain a length of over 4 feet. Of these the squirrel lives in the higher parts of the island, and the other four I saw chiefly in the neighbourhood of the Tusla sand dunes.

The birds would form an interesting study, chiefly because Imbros lies near to important migration routes. The indigenous birds include the following: in the higher hills, an eagle and a buzzard (or similar bird); on the low ground, the pied wagtail; all over the island, ravens, hooded crows, and red-legged partridges, all numerous; also owls, kestrels, and sparrow-hawks.

The summer residents include the roller, hoopoe, yellow wagtail, and wheatear, the latter being very common.

The winter residents include the blackbird, lapwing, redbreast, goldcrest, stonechat, redstart, wren, goldfinch, greenfinch, chaffinch, a warbler, a goose and a teal.

In addition to these I observed the following resting during the autumn southward migration: the swallow, and many small birds chiefly of the

warbler kind. During November and December I noticed many flocks apparently of geese, flying north-eastwards up the Gulf of Xeros.

Amongst the insects there are several to which I can put no name; but those which are most important as pests are the ants and house flies, the latter being, of course, abnormally numerous in 1915; mosquitoes are not numerous. The most striking feature about the insect life is the great number of centipedes, large grasshoppers, and humming-bird-hawk moths.

Man and his Work.—The study of the mode of life of the inhabitants of secluded spots such as Imbros is of the greatest interest to the geographer, as life in such places is influenced almost solely by environment. It is, therefore, a matter of regret to me that, owing to my ignorance of the language and to lack of time for observation, I can give only the most superficial notes on this interesting topic.

The inhabitants are Greeks, but as regards their origin I think an anthropologist would hesitate to generalize. Their language and religion at any rate are Greek. The men seem to be blonde and dark in about equal proportion, and not infrequently I noticed in the dark men wide cheek-bones and the Mongolian eye. Of the women I can say nothing, as after the harvest—which I missed—they were never in evidence. One of the habits acquired from the Turk is the concealment of women and the wearing of a modified *yashmak* out of doors. The men generally wear the distinctive costume of the islands—the older men all do so. This consists of very baggy trousers, reaching below the knee, and often bearing some scroll braiding on the front of the thigh; thick woollen stockings and goatskin shoes; a broad *kummerbund*; coloured shirt; braided jacket reaching to the waist; and a skull cap, often red like a fez, with a wisp of white cotton round it.

These people are shepherds or goatherds and cultivators almost entirely. I believe there are also fishermen, but I have visited no fishing village. They live in small, low houses of undressed stone and mud roofed with red tiles made in the northern basin. The only feature of the houses worthy of notice is that there are the minimum number of windows, and that each house has a small porch, in which wood and grain are kept. In their general aspect they resemble the squat Hebridean hovel, like them being built to weather a heavy gale.

The cottages are the same whether in the villages or scattered singly over the hills, wherever the soil can be scratched for sowing. The villages are simply collections of these cottages, and are built without plan. In the case of one or two, however, there are streets of two-storied houses as well as an orthodox church, and in one case a disused mosque. They are scarcely ever built on the seacoast, and never on a low beach. In the area under discussion there must be between thirty and forty villages of all sizes, and of these only five or six are below the 200-foot line. The village site is usually either the slope or top of a mountain spur or an isolated knoll. They are never in the valley bottoms or near the streams.

The considerations which seem to have weighed in the selection of these sites are first the horror which all Mediterranean coast people have of lagoons and swamps; this takes them back from a flat shore. Secondly, they must not be too far from their fields. Moreover, as they have herds of goats and sheep and a few horned cattle which browse on the higher scrub, it is convenient to have their villages about the junction of cultivation and scrub. In short, the village is usually above the fields that it cultivates. It avoids a stream course to ensure security against sudden flood. Why rocky knolls and spurs should be selected is not so clear; possibly for defence, but this is unlikely on Imbros. More likely I think is it that in view of the scarcity of good land the people will not occupy it with their dwellings, and so select some rough site.

Besides the houses the only essential feature of the village is the threshing-floors. Nearly every house has one of these, and they form a very striking feature. They are in the open, and consist of round floors built of a carefully made mosaic of flat stones, and enclosed by a ring of large stones. Their diameter may be as much as 50 feet. On these floors the corn is trodden out by the hoofs of asses or ponies, which are driven round and round the circle. Another common feature is the windmill. These are numerous near the villages facing the sea. They are round stone buildings with conical roofs. The sails are small triangles of canvas at the extreme ends of straight bars of wood, and there are any number from ten to twenty-four of them. Water-mills are much less common owing to the lack of permanent streams, but they are to be found in the larger basins.

The methods of cultivation employed are primitive in the extreme. The wooden plough of to-day, which is drawn by two oxen, must have been used for at least 2000 years; and I have seen a small field-cart in use which had for its four wheels the solid cross-sections of a tree-trunk. Besides the plough the only implement is the mattock.

The chief crops grown on Imbros are wheat and barley, maize and beans, the currant, grape, and the olive. Ploughing for the grain crops and sowing begin with the rains in November, and go on till the end of January. The harvest is finished by the end of July. The grape vine is grown in the usual Greek fashion—*i.e.* the shoots spreading from the ground and unsupported by stakes. Vineyards are found in sheltered valleys up to about the 700-foot line.

The types of land under cultivation in the island are capable of some classification. First there is the most important type—the wide alluvial fans, which are entirely covered with fields, vineyards, orchards, or olive groves. There is no division between fields except possibly a ditch. No irrigation appears to be necessary. Fields are periodically left fallow; but I cannot say if rotation is practised. No manure is applied to the fields either here or in other situations. The olive groves usually have a grain crop, such as maize, growing between the trees.

The three difficulties which apparently stand in the way of the Imbros farmer in all other situations than that described are—to maintain sufficient soil on his field, to ensure that the crop gets enough water, and to keep animals out of his fields. The water and soil difficulties occur chiefly on valley sides, and the third along the streams where animals come down to drink.

This will explain the precautions used in the cultivation of the types of land still to be described. These are first, the slopes of the high, wide valleys described earlier in these notes, and the slopes of the interior basins. In both cases the land is terraced by rough retaining walls, to prevent the soil creeping away too quickly. In these situations no irrigation is employed, though water must often be scarce enough. Apparently such an elementary precaution as careful weeding is not taken, and there is no special preparation of the soil made to retain moisture. Secondly, in little hillside gullies which have a spring at the head, and in which a certain amount of soil has collected, there is a much more careful system of terracing, sometimes reaching right to the foot of the gully. These terraces both retain the soil and permit of irrigation. Summer evaporation is no doubt retarded by the shade of the poplars which line such terraces.

Thirdly, there is the cultivation of the steep valleys of the rejuvenated streams. Usually in this case there is no cultivation of the valley sides, except in the tributary gullies. But in one glen I have seen ploughed slopes of not less than 35° inclination, and on these there were no terraces. It is difficult to understand the purpose of this; either the farmer lacks foresight, or else he is trying an experiment—surely a phenomenon on Imbros!

On the lowest slopes of some of these deep consequent valleys a considerable thickness of soil has accumulated. This is apparently very valuable, as it is parcelled out in small lots. The picture presented by such a valley is most attractive, for the numerous small orchards and the attractive waterside willows and poplars make an enticing belt of foliage. But woe betide the wanderer who tries to walk up such a valley. For to preserve their crops against the sheep and goats which browse on the scrubby slopes above, the farmers have hemmed in every field with a dry stone wall surmounted by an impenetrable *zariba* of thorn.

The simple peasant of Imbros may be said to have utilized the possibilities of his environment so far as the means at his disposal and the methods introduced by his early ancestors allow him. But there is little sign of inventive genius. The peasant's tastes are simple and the island supplies his wants. His food is a heavy brown bread and goat's-milk cheese, olives and oil, beans and green vegetables, with meat occasionally. He keeps some poultry, and if he has a gun he bags a partridge or a hare now and then. He makes his own wine—harsh to us, but pleasant to him. Oxen draw his plough, and hill ponies carry his load when he moves; in winter he has sufficient charcoal fuel, which he makes from the

abundant scrub stems. He will never be rich with his present methods; but up till now he has received no encouragement to save money, as the Turkish tax-gatherer would be sure to get to hear of the saving, and take extra toll of him.

But after all the Imbros peasant, if he does live in an economic backwater, still has his compensation in that he lives in one of Nature's beauty spots. For these Greek islanders must possess a strong sense of the wonder of Nature—in other words, their environment means more to them than mere food and drink—or why do they perch their little chapels on every prominent hilltop?

If we climb to one of these—and let us select one in the centre of the island—what do we see? Immediately to east and to west extends a narrow, wavy ridge, the grey of each successive rocky dome thrusting itself up from a mottled sea of rich and sombre green, which, rising from the north in a paler hue to the troughs between the crests, passes through and down the opposite sweep to the south; and the upward and the downward curve are of a beautiful symmetry. From each trough or saddle there runs to either side a deep-cut rocky ravine, in winter filled by a plashing burn, and in summer filled with oleander's pink. In most of these hollows some man has built his home, planted his poplars and olives, and sown his maize; it is his goats which, with a soaring eagle, provide the only animation to the scene; their tinkling bells the only sound, and that sound is harmony; the bells are still home-made.

Farther and farther down the sweep more and more men have their work, and the mottled scrub gives place, first in patches then altogether, to the beautiful silver-green shimmer of the olive. And on the slopes all round this pale-green sea of trees are dotted in clusters the houses of the men who work in it. Above the villages, and still to the north, is another mottled green upward sweep with poplar-lined gullies, the green thrusting itself in patches high amongst the steep crags of the lofty sea-wall of Imbros.

To the south the basin is not so completely in the hands of Man, and the tints of green and the red and white dots which denote his presence are arranged in stripes, separated by low but steep craggy and wooded ridges. The southern rim presents the contrast of a smooth hill-slope, scored by the plough almost up to the bold escarpment of grey rock—a long and regular line, but broken by gaps through which we catch glimpses of the blue Ægean Sea.

A great gash in the northern ridge and the sight of a tiny harbour remind us that the Imbros goatherd still has brother Greeks who go to sea; and the wonderful view through the gap and across the water shows us afresh why his ancestors were first tempted to cross the seas. Right opposite stands the mighty pile of Samothraki. It rises like the side of a Norwegian mountain, which indeed it closely resembles in its winter guise.

Samothraki was one of the seats of Zeus, and our thoughts of the god

turn us to the south once more to seek Mount Ida. We find it forming the crown of the Asiatic horizon, raising a shimmering white head over the intervening stripes of hazy purple and blue and greyish-green—the Trojan hills, the Hellespont, and the long line of the Peninsula in front slowly dropping to the Helles cape.

Whether you are a foreigner or a native; whether you climb to that ridge with a 'Homer' in your pocket or not; whether you come to see the peaks of Samothraki tinted by the "rosy-fingered dawn," or the peak of Tenedos and the hills of Lemnos silhouetted in a golden evening light, you cannot fail to be impressed with the spirit of the Ægean.

OBSERVATIONS ON THE NORTHERN SECTION OF THE TANGANYIKA-NILE RIFT VALLEY.

Captain C. H. Stigand.

REJAF, on the Upper Nile, has long been known as a centre of earthquake disturbances; its name is the Arabic for earthquake, and was given it on this account. Practically every year one or two rumbles are heard, and these are sometimes accompanied by slight tremors. No serious shocks, however, have been reported in recent times until those which have occurred lately.

In 1914 there was a continuous series of rumbles and tremors, very often a number in one day, and several severe shocks were felt, noticeably that of May 21, which destroyed or damaged most of the few buildings in the station. These earthquakes may be explained by the presence and development of a great fault system in this region.

The main lines of fracture of the Earth's crust in this locality seem to run north and south. Indeed they appear to follow this direction elsewhere on the continent, as indicated by the shapes of Lakes Nyasa and Tanganyika and by the trend of the Eastern Rift valley. A glance at a map will show that the southern part of what used to be the Lado Enclave is exceedingly narrow. The Lado Enclave was bounded on the east by the Nile, and on the west by the Nile–Congo watershed. This narrowness of the southern Enclave therefore means that the main channel of the Nile here flows but a short distance from the Congo basin. In some places the Nile is less than 30 miles from the waterparting. This circumstance also appears to be due to the fault system of the district; a line of strike fault having raised up the country on the west bank of the Nile and formed of it a high tableland bounded in places by steep escarpments comparable to those of the Eastern Rift valley. At the foot of these escarpments flows the Nile.

This fault line first appears as a noticeable escarpment to the west of Rejaf and continues from there to the south end of Lake Albert, a

distance of about 300 miles. Probably it could be traced further northwards and much further southwards; I am only referring to that part of it which is an obvious geographical feature. The edge of the plateau is indicated on the map opposite.

Travelling inland from Rejaf along the automobile road which runs roughly south-west: after covering nearly 30 miles one meets a low ridge crossing the road from north to south. To the north of the road this ridge rises into a long hill called Kidi, its longer axis being north and south. If the ridge is followed southwards it will be found to continue, gradually rising, as far as the Kaia River, where there is a sharp break which lets that river through from west to east. On the other side of the Kaia the same feature continues, but it has now become a steep escarpment bordering the high tableland to the west. This escarpment, the top of which is some 1500 feet above the Nile level, continues to the neighbourhood of Dufile, broken in only one place where it lets the Ayu River pass through in a deep gorge.

The section between the Kaia and the Ayu might suitably be called the Kuku escarpment, after the tribe which inhabits its summit. Between the Ayu and Dufile the escarpment is in the nature of a long mountain called Nyiri, which rises to the height of 5000 feet above sea-level and 3000 feet above the Nile. The eastern side of Nyiri drops by successive precipices to the Nile, whilst the western side drops equally steeply but only 1000 to 1500 feet, to reach the general level of the highlands; whereas from the Ayu northwards the Nile flows with the escarpment on its left bank and comparatively flat and level country on its right, along this latter section, Nimule to Ayu, there is a steep rise also on its right bank. Here the river is situated in a gorge, with the Nyiri Mountains rising 3300 feet above it on the one side and a ridge about 800 feet to 1000 feet above it on the other. In this section of the Nile Valley are situated the Fola Falls and the majority of those rapids which make the stream unnavigable ftom Nimule to Rejaf.

The north end of the Kuku escarpment, where it turns round to the west to let the Kaia through (see map), descends in one sheer drop. Where, however, it faces the Nile, from the northerly corner to near Dufile, it rises in two or more terraces. For instance, a section from south-west to north-east across the centre of the Kuku escarpment has the form illustrated in Fig. 2, p. 152. A similar section across the Nyiri Mountains, also from south-west to north-east, is illustrated by Fig. 3.

Just to the north of Dufile the escarpment, still bordering the highland country, makes an abrupt turn to the west and proceeds in this direction for about 30 miles. This section can conveniently be called the Madi escarpment, after the people who inhabit both its summit and its base. From the end of the Madi escarpment the edge of the plateau turns southwards again, but it has now lost its precipitous nature. This section as far as the Ora River represents a steep rise from the 2000 feet

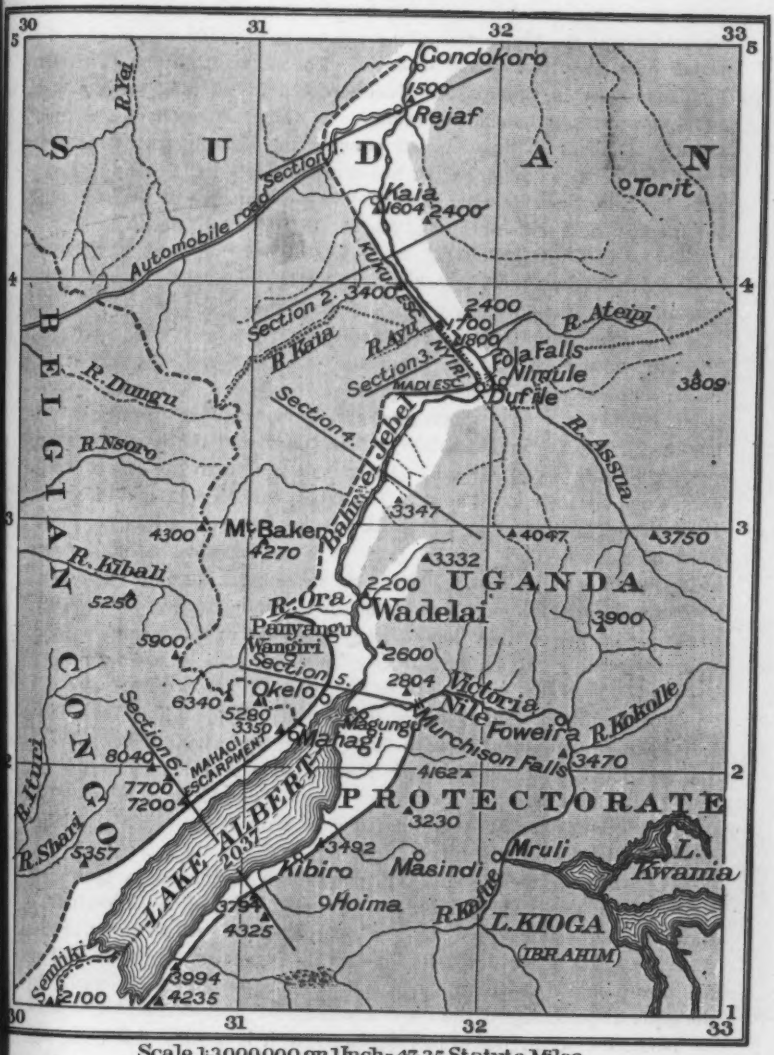
THE NORTHERN TERMINATION OF THE TANGANYIKA-NILE RIFT VALLEY

TO ILLUSTRATE THE PAPERS by CAPTAIN C. H. STIGAND & Mr. ARTHUR HOLMES

Edge of Plateau bounded by Escarpment

" " " Series of small Scarps

The Shaded Portion represents Plateau



Scale 1:3,000,000 or 1 Inch = 47·35 Statute Miles.

20 10 0 20 40 60 Miles

Heights in feet.

of the Nile to the 3500 feet of the edge of the plateau and the 4000 feet or so of the waterparting, but there are no well-defined escarpments.

On the south side of the Ora is situated a broad plain called Panyangu, bordering the Nile and not many feet above it. To the west of this plain there is a precipitous ascent to the Wangiri country, an upland situated about the headwaters of the Ora at an altitude which must be rather over 4000 feet above sea-level. To the south of Panyangu the highlands close in towards the Nile, bordered by an escarpment which trends eastwards and then southwards. At Okelo only a narrow strip of country a mile or so broad is left between the foot of this escarpment and the river, whilst at Mahagi it has already reached the shore of Lake Albert. It forms steep precipices along the western edge of the lake until towards the south end it begins to lose its precipitous nature.

The recent earthquakes do not appear to have followed this line of strike fault. The severest shock felt at Rejaf, which place seems to be near the focus of disturbance in this region, was also felt severely at Torit, in the Latuka country to the east, and was noticed as far as Nyangara, 300 miles westward. To the north and south, however, the severity of the shock seems to have died out quickly.

The different spots at which shocks were observed are practically confined to the few stations existing in these parts, and the evidence as to relative severity is very meagre. There is no station to the east of Torit, and so one does not know how far the shock extended in that direction. It is certain, however, that the shock was not felt severely as far to the north of Rejaf as Torit is to the east. Nor was it noticeable as far south as Nyangara is to the west. This shock, and most if not all of the others, undoubtedly were felt most severely on an east-and-west line, which points to the probability of there being a transverse fault in this neighbourhood, running probably through the Latuka country, through Rejaf or a little to the south.

Other foci in these parts appear to be in the neighbourhood of Kibiro, halfway down the eastern shore of Lake Albert and about Kivu, approximately lat. 2° S. Emin reported frequent shocks at Kibiro during his time, whilst in December 1911 shocks were reported from Kivu. The former place is practically on the line of strike fault, whilst the latter might well be on a southern extension of it.

The waters of the Victoria Nile have been obstructed in their flow westwards by this fault and so, after forming Lake Albert, have had to turn northwards along the foot of the escarpments to seek an outlet in that direction. The sheer drop which makes the Murchison Falls, as well as the escarpments between the lake and Hoima, was probably caused by the same displacement of the Earth's surface.

Before the occurrence of this displacement it is possible that there was no drop of the Nile at the Murchison Falls, so that the river flowed from there onwards at a higher level than it does at the present time. It now

MURCHISON FALLS.

G. Ishmael, Photo.

WALL OF THE GREAT VALLEY ON THE NORTH COAST OF LAKE ALBERT.

J. E. S. Moore, Photo.

WALL OF THE GREAT VALLEY ON THE NORTH COAST OF LAKE ALBERT. J. E. S. Moore, Photo.

flows westwards into Lake Albert, but at that time there may have been no Lake Albert and no Mahagi escarpment to block its further progress in the same direction. The question thus arises as to where the Nile went to.

Let us assume that the Nile reached a point to the west of the present site of Mahagi. Taking a map and tracing the line of least resistance from such a point, and remembering that what are now the highlands of the present watershed may have been non-existent, several possible outlets may be considered. It might be brought back again by a bend into its present channel below Rejaf, or perhaps even into the Bahr-el-Ghazal; again, it may perhaps have passed through Wadai and into the Mediterranean near Tripoli. In connection with the latter suggestion there is a striking piece of independent evidence. The Boyd-Alexander expedition, if I remember rightly, discovered that the fish of Lake Chad bore a remarkable resemblance to those of the Nile Basin, and a marked dissimilarity to those of the nearest drainage systems with which one would naturally associate them. Given a former Nile leaving a point some distance to the west of Lake Albert, and starting from there with a northerly or north-westerly course at a height of some 2000 feet above sea-level, it seems reasonable to suppose that it would have a very fair chance of connecting up with Lake Chad. The discovery of an old channel would settle the matter.*

NOTES ON THE STRUCTURE OF THE TANGANYIKA-NILE RIFT VALLEY.

Arthur Holmes.

IN the preceding paper Captain Stigand has given a connected account of the tectonic features of the Nile Valley, from the northern end of Albert Nyanza to Rejaf. This region, comprising the northern extremity of the Tanganyika–Nile Valley, is evidently a critical one in past and present African geography. So long ago as 1891 Suess, in a masterly paper ("Die Brucke des Ost-Africa." *Denk. k. Ak. Wiss. Wien*, vol. 58 (1891), 1892, p. 562), drew attention to the significance of the Wadelai–Gondokoro gorge

* Since writing this I have been interested to read Mr. F. R. Cana's article in the November number, "The Sahara in 1915." It seems to me that the Wadi-el-Fardi, which he refers to as "the dried-up bed of a once great river," is no other than the old channel of the Nile which I suggested above ought to exist. If this is so, the old course should be somewhat as follows: Mahagi westwards and then northwards, passing perhaps somewhere about the boundary between Darfur and Wadai, and continued northwards by way of the Wadi-el-Fardi.

Another interesting statement in Mr. Cana's article is that Çaptain Vignon, who visited the Bahr-el-Ghazal (the Chad river of that name, not the Nile one), believed that it flowed eastwards—and not westwards—that is, that it is an *effluent* and not an *affluent* of Lake Chad. If this is so, it does not require a great stretch of imagination to conceive of this river rising in Lake Chad as an old tributary of a former Nile passing through Wadai or Darfur, or just between the two.

in the history and evolution of the Nile. It has been suggested to me by the editor that the publication of Captain Stigand's observations affords a suitable opportunity for discussing, in the light of our present knowledge, the structure of this fascinating district. It is hoped, therefore, in the present paper, not to arrive at any definite conclusions—the material available is as yet far too scanty—but to direct attention to some of the problems that await solution and to stimulate future travellers to collect data pertinent to their solution.

The plateau of Central Africa west of Victoria Nyanza has been rent by a curvilinear series of fractures which is responsible for the remarkable rift valley stretching from Tanganyika to the Nile—a rift valley even more spectacular than the better-known Eastern or "Great" Rift valley. Passing from north to south the dislocations tend to become more intense, though the uniformity of the trough, both in width and depth, is interfered with by the great upthrust massif of Ruwenzori and by the volcanoes of Mfumbiro. Ultimately the fracture system fans out at the southern end of Tanganyika. At this latitude a broad belt of country has suffered dislocation. To the west of Tanganyika lies the rift valley of Upemba, through which the Lualaba takes a north-easterly course. To the east the rift valley of Rukwa appears, springing from the volcanic field at the north of Lake Nyasa, and thus connecting the Tanganyika–Nile system with the Great Rift-valley of East Africa, and with the Nyasa trough and the sunk-lands of the Shire.*

The two walls of a rift valley rarely die out together. In almost every case where the terminations have been traced, one of the walls is found to persist as an escarpment which may remain conspicuous for many miles after its former neighbour has faded out as a geographical feature. Moreover it often happens that the fault-scarp which towards one extremity is the first to disappear or to lose its normal boldness, is that which continues to persist towards the other extremity. These characters are admirably illustrated by the Tanganyika–Nile Rift valley. Regarded as a whole, the fractures on the eastern side fade away towards the north and become topographically insignificant beyond the Victoria Nile; while in the south it is on the eastern side that continuation is effected with the Nyasa trough. Regarding only the northern section—from Ruwenzori to the Nile—the bold western wall stretches north beyond the automobile road from Rejaf, but almost dies away where it is invaded by the Ituri forest in the south; the eastern wall, on the contrary, culminates towards the south in the unique heights and precipices of Ruwenzori.

Captain Stigand's observations are particularly valuable because they refer to the northern and terminating section of this great fracture system. The letters of Emin Pasha contain good local descriptions, and record

* For numerous references and maps, and a detailed description of the African fractures, see *La Face de la Terre*, E. Suess (French trans. by E. de Margerie), Tome III., pt. 3, pp. 957 *et seq.*, 1913.

many geological observations that bear on the subject here being discussed. Unfortunately Emin Pasha failed to correlate his scattered observations, and he never attempted to describe the structure of his province, though the long lines of escarpment that diversify its face seem often to have aroused his interest.*

The escarpments are indeed the most striking feature of the landscape. They mark the course of a series of faults which, with one exception, may be regarded as strike faults for reasons that appear below. On the preceding (p. 147) map, plateau, escarpment, and valley are diagrammatically displayed. Where the escarpment is steep and well defined its summit (*i.e.* the edge of the plateau) is indicated by a continuous line; where the change in level is less abrupt, or by a series of descending steps, a broken line marks the edge of the plateau.

On each side of the valley the plateau is predominantly composed of gneisses, accompanied by mica and hornblende schists and intruded upon by granites and pegmatites.† As is frequent in Africa, the foliation and banding of the gneisses and schists often maintain a uniform strike for long distances. On each side of Lake Albert the gneissose bands run from south-west to north-east. At the northern end of the lake (*e.g.* Magungu, where mica-schist occurs) the strike turns and is nearly north and south. From near Wadelai to Dufile the former direction is resumed, but near Dufile the trend of the rocks becomes parallel to the course of the Assua River, *i.e.* north and south. Further north the strike turns towards the north-west and runs across the transverse course of the Ateipi River, parallel with the Nyiri escarpment on the other side of the Nile. South of Rejaf the foliation gradually reaches the north and south direction again, and this direction is faithfully followed by the longer axes of many of the hills which diversify the plateau. It will now be clear from the map that in this region the direction of foliation is everywhere the chief factor which has controlled the direction of the fault escarpments and the course chosen by the Nile. The Madi escarpment westward from Dufile represents a transverse fault located in, and approximately bisecting, the angle made by north-east and north-west lines of strike, but throughout his tectonic zone no other east-and-west fault is responsible for a topographical feature till Ruwenzori is reached.

Captain Stigand in the preceding communication has described the fault escarpments on the western side of the Bahr-el-Jebel from Rejaf to

* 'Emin Pasha in Central Africa' (English translation, 1888). Except where other references are given, the geological details mentioned in this paper are taken from this edition of Emin Pasha's correspondence.

† Conglomerate occurs some 30 miles west of Wadelai, and conglomerate and clay south-east of the Murchison Falls (Emin Pasha).

"On reaching the escarpments of Lake Albert one finds a narrow belt of slates, mostly mica-schist, that varies from 2 to 4 miles in width . . . having a trend from north-east to south-west . . . Trap dykes cut the formation in several places" (*African Standard*, 29 August 1903).

Lake Albert (sections 1–5). The steep precipices of the Mahagi escarpment border the western side of the lake along the greater part of its length (section 6). Here and there cascades of clear cold water leap out from

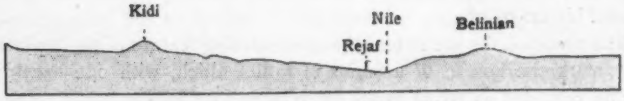


Fig. 1.—Section through Kidi and Rejaf.

Fig. 2.—Section across the Kuku Escarpment.

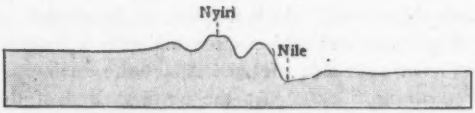


Fig. 3.—Section across the Kuku Escarpment.

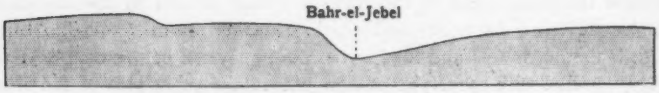


Fig. 4.—Section across the Bahr-el-Jebel.

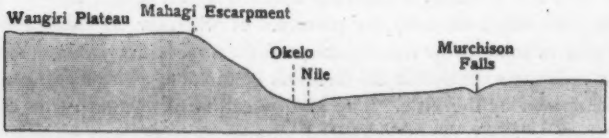


Fig. 5.—Section through the Mahagi Escarpment and the Murchison Falls.

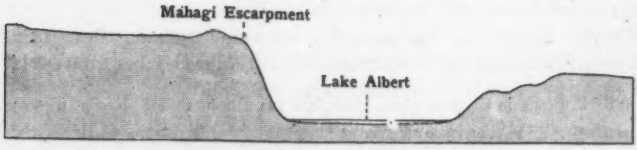


Fig. 6.—Section across Lake Albert.

hanging valleys hundreds of feet above the lake, and below them alluvial fans grow slowly outwards, affording to the natives ideal spots for settlement and cultivation along an otherwise forbidding and inhospitable shore.

Towards the south the escarpments retreat to the west and begin to lose their steepness. For 50 miles beyond the lake the Semliki Valley is bordered on the west by mountainous slopes (section 7), but there are

Fig. 7.—Section across the Semliki Valley, North of Ruwenzori.

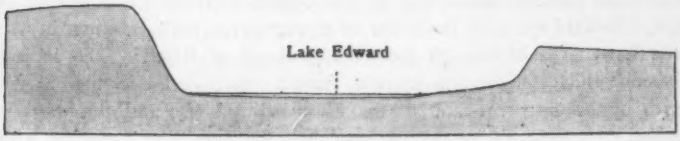


Fig. 8.—Section across Lake Edward.

Horizontal Scale 1/1,200,000
Miles 5 0 5 10 15 20 25 Miles
Vertical Scale 1/150,000
Thousands of Feet 5 0 5 10 Thousands of Feet

no prominent escarpments. The elevation of the plateau also falls, and the western wall of the rift valley becomes inconspicuous for a time in the gloom of the Ituri forest.

A glance at the seven sections mentioned above (arranged in order from north to south) indicates that from Rejaf to the middle of Lake Albert the plateau on the west is considerably higher than its neighbour across the valley. South of the Murchison Falls the western escarpment begins to be mirrored across the lake in a well-defined parallel scarp, which soon rivals its neighbour in boldness. Writing in 1885, Emin Pasha says: "The geological formation [gneisses, schists, and granites] of both ranges is the same; their altitudes differ but little, and the terrace-like formation of their descent lakewards is in each case exactly alike" ('Emin Pasha at the Equator,' p. 171). As the northern spurs of Ruwenzori are reached south of the lake, the rift valley narrows, the western face falls away, the plateau behind it is now below the plateau to the east, and the latter drops abruptly to the flat alluvium of the Semliki. Further south the eastern wall culminates in the gigantic upthrust of Ruwenzori. The wide, flat-bottomed trough of Lake Edward is bifurcated by the Ruwenzori massif, one branch passing down the Semliki to unite with the northern section of the rift valley, the other diverging to the north-east by way of Lake George (Ruisamba). Across Lake Edward the rift valley resumes its normal aspect, the western side of the plateau again rising high above the eastern (section 8).

The western series of strike faults falls naturally into three divisions: (*a*) from Kidi, gradually increasing in intensity to Dufile; (*b*) from the western end of the Madi escarpment, gradually increasing in intensity, to the middle of Lake Albert; and (*c*) from there, gradually decreasing in intensity, to the Ihiri Forest. The first of these is limited to the south by an east-and-west fault, and it appears to have been hinged up about an axis running in a similar direction between Kidi and Rejaf. Moreover, the position thus suggested is one which bisects the angle formed by the N.W.-S.E. line that leads up to Kidi, and the N.E.-S.W. line of the gneissose hills which strike towards the Nile from that point. Significant in this connection is the evidence which Captain Stigand brings forward (p. 148) in favour of a transverse fault running in the direction suggested through the neighbourhood of Rejaf.* The second division, which may in the future be further subdivided, is limited to the north by the east-west fault of the Madi escarpment; and the third is limited to the south by the east-and-west fractures that (together with a series running north and south) have rent the rocks of Ruwenzori. (De Filippi, 'Ruwenzori,' p. 390, 1900). Here, again, earthquakes have frequently been recorded. Between the second and third divisions, that is, somewhere across the middle of Lake Albert, one would expect to find an axis of movement, and it is interesting to notice that Kibiro is, in accordance with this view, a recognized earthquake centre (see, for example, A. F. R. Wollaston, 'Ruwenzori to the Congo,' p. 92, 1908).

The occurrence of earthquakes at Rejaf, Kibiro, and Ruwenzori indicates that the movements which have upheaved and tilted great blocks of the Earth's crust in this region are still in progress. The Nile itself suggests that much of the displacement may have been effected within, geologically speaking, recent times. Dr. W. F. Hume writes as follows: "The upper Nile, or Bahr-el-Jebel, passes without any marked break from the condition of tumultuous youth to one simulating all the characters of fluviatile old age. From north of Dufile it sweeps through a narrow ravine, rapid succeeding rapid, then suddenly emerges into the plain tract at Gondokoro" ("Notes on the History of the Nile and its Valley," *Geographical Journal*, **27**, p. 52, 1906). Major Lyons has drawn the same deduction from the moderate amount of weathering on the equatorial plateau, and from the incomplete development of the drainage systems between the Victoria Nyanza and the Congo Basin ("Some Geographical Aspects of the Nile," *Geographical Journal*, 33, p. 452, 1908).

The question of the rate and direction of present-day movements next arises. In 1886 Emin Pasha built a station on the little alluvial island of Tunguru, near Mahagi. Writing two years later, Mounteney-Jephson says: "Owing to the rapid fall of the lake it had now become a peninsula, and

* For an interesting account of the relation of earthquakes to faults see the paper by Dr. C. Davison in the *Geographical Journal* for November 1915, **46**, p. 357.

stood on a long spit of sand running about a mile and a half into the lake. This spit is constantly increasing owing to the fall of the lake" ('Emin Pasha: The Rebellion at the Equator,' p. 40, 1890). Another explanation that has been advanced is that the floor of the lake is, or was then, actually rising. As it stands, however, the evidence cannot be held to prove either a fall in the lake-level, or a rise of its floor. It seems more in accordance with probabilities that the sand-spit in question was due simply to a local silting up. Emin Pasha observed the gradual formation of several sand-spits between the years 1879 and 1885, and he attributed them solely to the deposition of sediment brought down by the Semliki and carried onward by the current of the lake itself, until checked by some obstruction ('Emin Pasha in Central Africa,' p. 169).

More valuable evidence is afforded by the zoned park-lands which occur at the southern end of Lake Albert and which have been carefully described by J. E. S. Moore ('The Tanganyika Problem,' pp. 114 *et seq.*, 1903). These definitely indicate that the level of the lake has fallen, and confirmation is found in the old terraces, beaches, and watermarks discovered along the western shores of the lake. Precisely similar features characterize the borders of Lake Edward. Discussing alternative explanations for the fall of the lakes, Moore points out that there is no evidence that the rainfall is decreasing, and writes (*ibid.*, p. 118), "We are therefore driven to conclude that the existence of these extensive parks must be due to movements." The movements would, of course, be of the nature of a slow but widespread uplift. Old beach terraces occur along the eastern side of Lake Albert, though apparently at a lower level. It may be suggested that more conclusive evidence would be forthcoming if the beaches and watermarks were to be carefully mapped and levelled all round the lake. If, then, one side of the lake is being raised relatively to the other, the results could scarcely fail to disclose the fact. For the benefit of future researches on the rate of uplift, definite marks should be accurately fixed at various points around the lake.

North of Ruwenzori very little is known concerning the occurrence of volcanic lavas. It is probable, however, that eruptions took place not far to the east of Lake Albert at no very remote date. The belt of mica-schist that flanks the summit of the escarpment on the east disappears a few miles south of Fajao; it there dips to the south-east, and is overlain by volcanic rocks, the age of which is not yet known ('Notes on the Geology of the Continent of Africa,' War Office, 1904, p. 105). A curious statement in the *African Standard* for 29 August 1903 deserves investigation: "The whole country round is sown with fragments of glassy slag and iron slag. . . . The iron slag is mostly honeycombed, and is so rich in iron that on crushing the same in a mortar, the metal flattens out into small pellets. This is to be found anywhere between Lake Albert and Lake Victoria." Although the relation of vulcanism in its more spectacular phases to the fracture system is still entirely unknown, there are not lacking

evidences of the so-called decadent phases of volcanic activity. At Kibiro, near the foot of the escarpment, hot springs and jets of steam accompanied by sulphurous gases bubble and hiss their way through a saline earth which is greatly prized by the natives as a source of nearly pure sodium chloride.* Similar phenomena are met with on the other side of the lake a little way south of Mahagi, and here the hot vapours have corroded and softened the rocks and encrusted them with a yellow saline deposit. Other hot springs and sulphurous steam-jets occur about halfway between the Murchison Falls and Wadelai. Near the Assua River, where it would be met by a continuation eastwards of the Madi escarpment, boiling springs are found, in this case free from sulphur gases.

These facts are capable of various interpretations. Are the hot springs the first symptoms of a wave of igneous activity now advancing far below, or are they the declining phase of a former outbreak of vulcanism, the main force of which is already spent? The recent growth of new volcanic cones in the Mfumbiro district, described by Sir Alfred Sharpe (*Geographical Journal*, 47, p. 26, 1916), is a tragic warning against the danger of too lightly assuming the apparent stability of the depths.

Whether or not an outbreak of vulcanism will in the future devastate the flanks of the northern section of the rift valley is a question not to be disregarded. A careful recording of earthquake shocks with special reference to their frequency, and a periodic examination of the temperature and composition of the hot springs and fumeroles, might throw much light, not only on the mechanism of volcanic activity in general, but also on the course likely to be followed in the future by deep-seated activities in this district. Already the Mediterranean volcanoes are being studied with a view to determining criteria by which eruptions may be successfully forecasted.

The apparent recency of earth-movements in the neighbourhood of Lake Albert naturally leads, as Captain Stigand points out, to an inquiry into the former drainage system of the district. It is doubtful, however, whether the subject can yet be profitably discussed. So far there have been three main suggestions as to the former course taken by the Upper Nile. Suess (*Denk. k. Ak. Wiss. Wien*, 58, p. 562, 1892) and Gregory (*Geographical Journal*, 4, p. 513, 1894), impressed by the juvenile condition of the gorge from Dufile to Gondokoro and by the common presence of *Corbicula fluminalis* in both the Nile and Lake Rudolf, offer the suggestion illustrated in Fig. 9. Before the breaching of the plateau by differential subsidence, the sources of the Nile may have been to the north of the Latuka highlands. The drainage from the southern slopes would then be reversed, and uniting with the waters of Albert Nyanza would flow to the

* According to the *African Standard* (*loc. cit.*), "the water [of which the amount is not stated] from the hot springs contains about 300 grains sodium chloride, 32 grains potassium chloride, 15 grains calcium sulphate, traces of magnesium sulphate, magnesium chloride and carbonate."

east through Lakes Kioga and Salisbury, and so by way of the present Turkwell to Lake Rudolf. By subsequent elevation of the country between Rudolf and the Kioga system, and the upbuilding of Elgon and Debasien, the Turkwell would become separated from the Upper Nile, which was then enabled to take the direction it now pursues. To this view Hobley ('Notes on the Geology of Africa,' p. 100, 1905) has objected on the grounds that the Turkwell Valley is itself in a youthful condition. Moreover the distribution of *Corbicula fluminalis* is not in itself sufficient evidence to prove a former connection between the Nile and Lake Rudolf. The eggs may have been transported by birds or even by man. Again, the lakes and rivers of equatorial Africa must have been widely different from their present representatives even since the growth of Elgon, for on the slopes of the latter caves have been found at heights fully 2500 feet above the present level of the Victoria Nyanza. Taking this fact into consideration, Hobley (*ibid.*, p. 100) suggests that the waters of the formerly more extensive Nyanza drained to the north along the line of the Rusi and met with the valley of the Sobat near Nasser.

Fig. 9.—The Headwaters of the Nile before the breaching of the Latuka Gorge.

(After Suess & Gregory.)

Captain Stigand's suggestion that the Victoria Nile, before the Murchison Falls and the Dufile–Gondokoro gorge came into existence, proceeded further to the west and then turned north to connect with the Wadi-el-Fardi, receiving Lake Chad and the Bahr-el-Ghazal as a tributary, is based on a different set of facts (Fig. 10). Dr. Boulenger, from his examination of the fish of the Senegal, Niger, and Nile, found that these rivers contain many species in common. He was thus led, with excellent reason, to conclude that the three rivers must formerly have been in communication, perhaps by way of a large central lake of which Chad would

be the diminishing relic. A striking corroboration was given to this theory when Boulenger examined the fish collected from Lake Chad during the Boyd-Alexander-Gosling expedition, for with one or two exceptions the

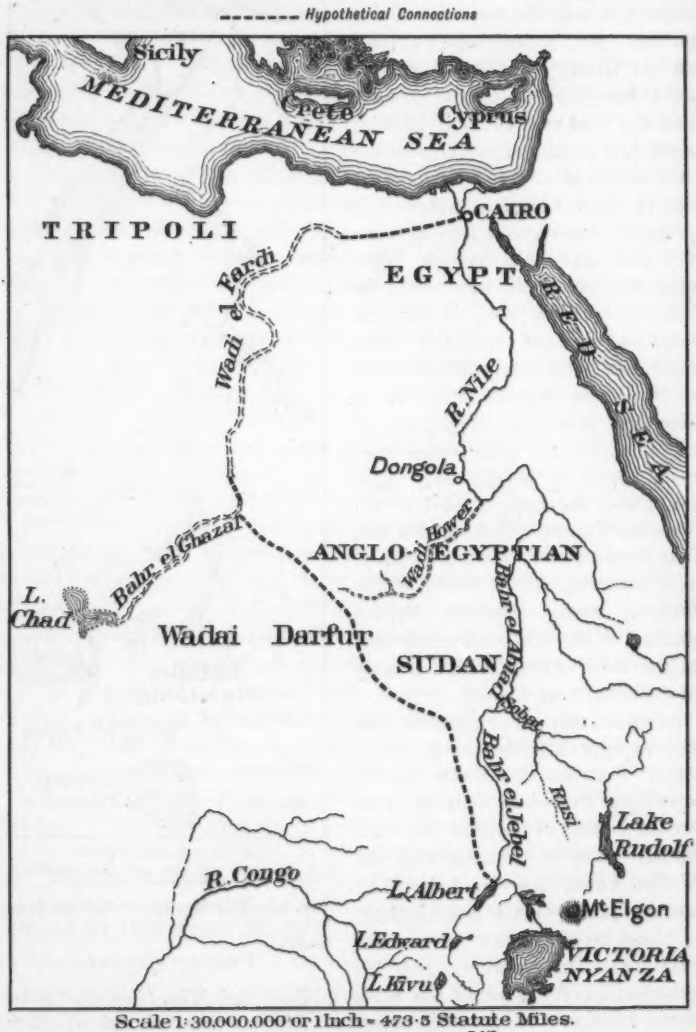


Fig. 10.

species were found to be common to the Niger or the Nile ('From the Niger to the Nile,' 1907, p. 315).

Considering now only the former connection of the Nile with Lake Chad, it should be remembered that Captain Stigand's explanation need not be the only one. If, as is supposed (F. R. Cana, "The Sahara in 1915," *Geographical Journal*, 46, p. 342, 1915), the Wadi-el-Fardi reached the Nile near the head of the Delta, then a connection of the Wadi with the Bahr-el-Ghazal would be sufficient to account for the common fish fauna of Chad and the Nile. It may also be considered whether the Bahr-el-Ghazal (of Lake Chad, not of the Nile) did not once connect with the Wadi Hower, which "according to native reports reaches the Nile near Dongola" (*Ibid.*, p. 345). Against this, however, is a doubt as to the very existence of the Wadi Hower.

Africa has still its mysteries even for explorers, and while the channels of the Wadi-el-Fardi and the Wadi Hower remain doubtful, who can satisfactorily trace the former connections of the Nile? Already the advancing traveller has dispersed most of the clouds of speculation in which Africa for long was shrouded. May the travellers of the future continue to unfold the more elusive secrets of the continent, and among them, let us hope, those of its volcanoes, its regional movements, and its river systems.

DR. TAFEL'S TRAVELS IN TIBET.

'Meine Tibetreise.' D'Albert Tafel (Berlin, 1914; 2 vols.); and "Reise in China und Tibet, 1905–8," *Geographische Ergebnisse*, Teil I., "China." S. Mittler & Sohn, Berlin. 1912.

DR. TAFEL'S travels in North-West China and Central Asia in company with Lieut. Filchner and subsequently by himself have been the subject of several reviews and notes in this *Journal*. The notices of his individual researches have mostly been based on communications addressed to the Berlin Geographical Society, published in the *Zeitschrift* and *Petermanns Mitteilungen* (vide *Geographical Journal*, vols. 27, 28, 29, 30). A preliminary account of the journeys was published by the Berlin Geographical Society in 1908, but a detailed history of the whole experiences of his long and eventful journeys such as has now been published has been awaited with great interest.

The first addition given to our knowledge is a description of a journey made, when on his way from Hankow to the Yellow River, to the country lying south of the west-east course of the Han River. Striking south from Kün-chou he made his way to Wu-tang-shan, a beautiful piece of mountain land in the eastern part of Ta-pa-shan, a range first visited by Père David, later by Richthofen, and more recently by Colonel Manifold and others, but still awaiting fuller exploration.

After reaching the T'ung Kuan bend of the Yellow River he spent

May and June in making a survey of the north-south reach of that river, and claims to have been the first European to reach Pao-ti since the seventeenth century, when Père Gerbillon accompanied Kang Hsi on his expedition against the Eleuths. The map which he has produced, on a scale of 1 : 200,000, is a wonderful piece of work in view of the immense difficulties which faced him in obtaining observations of the river's course. It is also in itself an exquisite specimen of workmanship. On the completion of this survey he struck east to So-ping *viâ* the sources of the Fen River and Yang-fang-k'ou, and then again west across the Ordos country to Kansu and so to the Yellow River near Ling Chou.

In reading the account of the journey between T'ung Kuan and Pao-ti and thence to So-ping, one is struck again and again by the picture the traveller gives of the desolation caused by the famine years of 1876–8. This tract of country is so little known that its sufferings during those cruel years passed unnoticed by the public, but from the traces left and still enduring it would seem that the natural poverty of the land rendered it even more sensible to the cruel scourge of famine than those other parts of Shan-si on which attention was most concentrated.

Several side excursions, the object of which is not quite clear, were made by Tafel in his travels. One of these in Hu-peh has been already mentioned. From Kuei-hua-chêng a short journey was made across the Ching Shan (the Yin-shan of maps); and from Ling Chou on the Yellow River a visit was paid to Fu-ma Fu, the residence of the exiled Prince Tuan, on the north of the Ala-shan Mountains. Returning from this point to Ning-hsia Fu, he again took up the mapping of the Yellow River, which with one break occasioned by the insuperable difficulties presented where the river passes through a cañon in the Nan-shan range, he carried on to Lan-chou. To the natural difficulties of the road were added others occasioned by the outcome of a struggle with followers of the Boxer general, Tung Fu-hsiang, who, in spite of his death as officially reported, was living in a fortress guarded by his own troops near Ning-ling-ting, in the rich irrigated country near the Yellow River.

Leaving Lan-chou for Si-ning Fu he gathered together all that was required for a long journey westwards. But on the shore of Kuku Nor an attack made in a wild winter storm at night robbed him of his transport and nearly cost him and his followers their lives.

Returning to Si-ning Fu he spent the winter in endeavouring to replace his losses. Part of the stolen property was recovered through the Chinese authorities, whose influence even in places out of their control was considerable, and some consolation was derived from the opportunity of witnessing the New Year ceremonies in Hsi-ning and the temples at Kumbum, Dankar and Wei-yuan-pu. The collection of nomads from Kuku Nor, Mongolian Tsaidam, Lhasa, and Kam, with their beasts and families; the great "butter" festival at Kumbum on the occasion of the feast of lanterns, the masks of the priests and the motley assembly of men

and women from all parts together with the hospitality shown to all guests are dwelt upon by Tafel with great delight. He himself was treated with great consideration by abbots, officials, and all. Nothing was hidden from him of the treasures of the temples, which he describes at great length. The services, which two thousand monks attend, are rendered specially imposing by the magnificent bass voice which breaks the stillness of the hall and is followed by an outburst of music from cymbals, flutes and drums, and the murmur of the hymn chanted by the priests.

From Si-ning he made an excursion to the Wei-yuan-pu, the home of the "Turen," formerly an independent people, but subject to China since the Ming dynasty. The striking dress of men and women and the great festival held at the beginning of the second moon are described with much detail and enthusiasm. There, as elsewhere, the writer showed an unusual ability for entering into the feelings of the people and making himself a welcome guest.

In the following May Tafel left Hsi-ning and striking south to the Yellow River crossed the Lao-yeh-shan, a range extending south from Kuku Nor, which forms the divide between the Yellow and Si-ning Rivers. Tafel alludes *en passant* to the gradual diminution in height of the range as it stretches eastwards, a characteristic which he found to be common to it and other ranges north of lat. 32°, and opposed to Richthofen's theory of a sharply defined ascent from China to the Tibetan plateau.

News of ravages by rinderpest forced Tafel to leave his pack-yaks behind in the Lao-yeh-shan, while he made a hurried visit to the south bank of the Yellow River, and thence to Kuei-tê. On his way back accident threw him almost into the arms of the same gang who had attacked him at Kuku Nor. But escaping this danger he rejoined his caravan and travelled with it to Shara Koto and Dunkar, another great religious centre.

Proceeding west he crossed the water-parting between Kuku Nor and the Yellow River, and at last reached the plateau of Higher Tibet where great valleys (*Yung*), filled in parts with piles of colossal stones and *débris*, point to the existence of large rivers in the past, but are now dry or nearly so. Here Tafel took a new route southwards across the great Ta-la steppe, which lies between the south Kuku Nor and Semenov Mountains on the north and south, and extends from the south-north bend of the Yellow River on the east to Dubassu Nor on the west. The unexpected discovery of a river, the Chabcha-chu, and cultivated ground in this region led to its identification with the Hu-yu-yung (whose source had previously been ascribed to the Dubassu Nor), after tracing it to the freshwater lake Si-ni-tso into which it empties itself.

Valleys filled in with blocks of stone, river courses diverted from their original beds, and occasional stretches of loess are some of the main features of the Ta-la steppe, which Tafel compares with similar features seen at Kuei-te, Si-ming, and also in Shan-si and the Han Valley. To

the loess he assigns a more recent date than to that occurring in the east, but the great depressions (*Yung*) now filled with blocks of stone are of an earlier age, and to the deep, ever deepening, ravines in which the Yellow River has cut its way he ascribes an intermediate date. Signs of climatic changes and of periods when a moister atmosphere than that of to-day prevailed are also evident.

Continuing south Tafel then struck across the Si-an-si-pei Mountains, which he found to be a part of the Semenov Range, to the country of the Si-dia tribe, near the Chu-rong River. This he speaks of as the largest affluent on the left bank of this section of the Yellow River. Foiled in an attempt to cross it he pushed west. Fever and the rains and storms which ushered in the spring in June rendered the journey slow and difficult; but the beauties of the season and the glorious views of the Amne Machin mountains, 20,000 feet, as seen from the shore of Tossun Nor, compensated in part for all the sufferings *en route*. Thence he made his way by the valley of the Yogho-re Gol to Barun Tsaidam, where he was well received by the Jassak and most courteously entertained, except by mosquitoes, which below an altitude of 13,000 feet proved most trying even to these hardened travellers.

On leaving Barun the caravan struck south towards the Burkhan Buddha range, which was crossed at the Turketse Pass (14,500 feet). At Odontala the presence of sand-dunes in the quivering morass presented a puzzle difficult to solve. Enormous herds of wild yak, antelopes, kyang, etc., and frequent bears gave life to scenes of great beauty, which changed almost in a moment to misery under the influence of rain and snow on a surface which yielded to any pressure. These morasses with their beauties extended west to the brook which Tafel claims to be the source of the Yellow River. In the lake close by he found the last home of hundreds of wild yak, driven to its waters by the fever of rinderpest. Fear of contagion forced the traveller to abandon this position in all haste, and marching south he crossed the range which forms the water-parting of the Yangtse until he came to the river itself. Tibetans prevented the crossing of the river and obliged him to turn westward until he struck and crossed the Chu-mar. Everything seemed favourable to the success of the journey, when an attack by Tibetans robbed him of his ponies, yaks, and sheep. Only six yaks were left; tents, food, clothing, and all scientific treasures had to be destroyed save such as could be carried by the party of travellers, and sadly they set their face northwards towards Taidshinar Tsaidam.

Only once did fortune smile on the disconsolate travellers as they journeyed north. For twenty-five days they saw no sign of any human beings. But two tame yaks abandoned as worthless by other travellers were a welcome addition to the carrying capacity of the party. As time went on loads had to be reduced, for neither man nor beast had proper food, and the high altitude immensely increased the strain. But eventually

after crossing the Marco Polo range by a pass (14,650 feet) they reached first Choga-gol, first discovered by Prjevalski, and after mounting another pass (14,000 feet), the Nachi-gol. But few animals survived, and all baggage had been thrown aside or cached before the first tents were reached at Golmo. Even then great difficulties had to be overcome before help was extended, for strangers were regarded with suspicion as possible spies of the dreaded Gholoks.

At Golmo animals were hired to fetch the more recently discarded baggage and to start the travellers on their way east. Passing through the country of the Dsun and Wang-ka Mongols, and skirting the Lakes Dubassu and Kuku Nor, Tafel made his way to Dankar (where he met the late Lieut. Brooke), and finally to Hsi-ning.

While refitting at Hsi-ning in preparation for the continuance of his explorations Tafel paid a visit to Kumbum, where the Dalai Lama was then staying on his way from Urga to Lhasa. With his usual luck the doctor obtained an interview with this sacred personage, through the good offices of Mr. Teramoto, a Japanese, who in the dress of a Mongol priest had visited Lhasa and was then in attendance on the Lama. The impressions formed in the interview seem somewhat to have toned down those derived from the very unfavourable criticisms current in the country of the Dalai Lama's pretensions, exactions, and private life.

On January 20 the expedition again left Hsi-ning and took the road south to Kam. Thanks to the cruel cold the country was in good condition for travelling, for the morasses on high altitudes through which in summer men and animals toiled painfully foot by foot were now frozen. But the danger of an attack by Gholokhs was ever present. After crossing many ranges, the highest of which lay by the Tsassora Pass (13,700 feet) in the Semenov Range, the party eventually reached the broad valley through which the Yellow River flows, and there found themselves in the arms of a very large encampment of Gholokh-Khorgan. But the experience was better than expected, and two days later the journey was resumed and the Yellow River (about 900 feet broad) safely crossed on ice. Soon afterwards a caravan returning from Hsi-ning to Kam was met; the two parties joined forces, and travelling south-west across the water-parting at Rava-niembo-la (15,000 feet) of the Yangtse and Yellow Rivers, proceeded by rapid stages past the headwaters of the Ya-lung to Tendu. In spite of the friendly relations which had existed on the journey with the caravan, now that it had reached the home of its chief at Tendu an atmosphere of suspicion and distrust sprang up, and accompanied the expedition until it reached Jerku-ndo (Rockhill's Jyékundo) on the Dre'chu or Tung-tien Ho. Great calls were made on the tact and determination of the leader of the party in order to overcome the difficulties and dangers which thus arose. But at Jyékundo a most friendly reception awaited him, and Chinese traders *en route* to Lhasa or established in the place added their welcome to that of the natives.

But an attempt made to travel further west into Nan-chen was forcibly checked, and requests made to the prince for permission to visit his territory were sternly refused. Finally the traveller was informed that he must leave Jyékundo. But though he had overstayed his welcome, his followers had not, and after he had started on his way south to Ta-chien-lu several desertions occurred among his most reliable men, who hastened back to dry the tears of Tibetan maidens, whom Tafel had refused to enrol in his company. The journey south practically followed Rockhill's route. After leaving the Dre'-chu valley much hostility was encountered at the hands of Tibetan monks, and the crossing of the Ya-lung was made under a hail of stones, which led to the loss of a mule laden with photographic plates of life at Tendu and Jyékundo.

At Ta-chien-lu Tafel determined to strike north through the mountains to Sung-pan Ting, a journey in which new perils were encountered in the swinging bridges which cross the foaming torrents. Even his dog proved faint-hearted when faced with these terrors, but more beasts were lost in swamps than from bridges. Persons who suffer from lack of excitement might do well to apply for posts as bridge-keepers in this country, where assistance to man and beast forms part of the keeper's duties. This part of Tafel's journey lay through the most exquisite scenery that can be formed by forests, water, and flowers at high altitudes, as described by Mrs. Bishop (vide *Geographical Journal*, vol. 10, 1897) in her account of her visit to Somoland, which lies a little east of Tafel's route.

On his way from Sung-pan Ting to Hsi-ning Fu Tafel struck north-west to discover the bend made by the Yellow River, which Watts and Birch are believed to have reached in 1900. This was found in lat. 33° 33′ N., long. 102° 15′ E., in a broad valley through which the river meandered in great curves, entirely out of character with the fierce torrent hidden in narrow ravines to which Tafel had been accustomed elsewhere. This discovery was the crowning exploit of his very eventful journey.

The book is full of most interesting information on the different sects of Lamaism which were met, of the customs of the people, their religious festivals, the habits of Mongols in encampments, of Tibetans in their villages, the attempts to introduce cultivation in high altitudes, of Chinese traders, Gholokh robbers, and Mohammedan fugitives from China. The adventures of travel and sport were most varied. The herds of wild yak recalled to mind in their numbers the buffalo of the American prairies; kyang and antelope abounded; eight bears were seen in a single day near Odontala; and troops of monkeys in the country between Jyékundo and Tachien-lu devastate the crops.

Of the journeys themselves and the additions made in them to geographical and geological science earlier articles in this *Journal* have given some details. But it is perhaps advisable to recall that the journeys were carried out on lines suggested by the late Baron von Richthofen in order to fill lacunæ in our knowledge of the Yellow River, Tsaidam, and the

west fringe of the Red Basin of Szechuen, and their results are embodied in Richthofen's 'China,' vol. 3. Among the physical features of the country to which attention is specially called by the author are the huge trenches in the Tala steppe, the erratic blocks and vast moraines in the Bayan Kara and other western ranges far distant from any existing glacier field, the existence of loess in widely separated districts in most of the country traversed, and the presence of sand-dunes among the morasses of Odontala, where holding ground for tents was difficult to find.

The photographs are excellent and most varied in spite of losses and many accidents, and the map (a second volume of maps of the journey in Tibet, in thirty-seven sheets, has been published, but is not in the library of the Society) which accompanies the second volume is well executed. Indeed, the only imperfection in the book is the index, which is not complete.

W. R. Carles.

REVIEWS.

EUROPE.

Early Distribution and Valley-ward Movement of Population in South Britain.—H. J. Fleure and **Wallace E. Whitehouse**, of the University College of Wales, Aberystwyth. Reprinted from *Archæologia Cambrensis*, April 1916.

The authors of this paper give evidence to show that the areas of South Britain attractive to primitive man were "dry uplands with a porous subsoil, suitable pasture, and a convenient water and fuel supply, with access to raw material for the making of implements" (p. 110), such as are to be found on the Chalk Downs, the Derbyshire Moorlands, the Pennine Range, the Yorkshire Wolds, and the Malvern Hills. A map (p. 107) shows their conjectural distribution in Neolithic times, during which, as well as possibly during much later times, people must have lived "mostly either on the uplands exceeding 600 feet in height or along a coastal fringe," whereas "modern man in South Britain lives, as a general rule, below the 400-feet contour line" (pp. 23–24). Among evidences adduced for the valley-ward movements are facts indicating the survival of descendants of the Neolithic upland folk in inland valleys of those uplands and some features of "the distribution of old villages in several districts along hillsides sloping down from prehistoric uplands" (pp. 124–126). Nearly all the lower tracts in early times must have been forest or marsh, and the descent of man was prepared for by the downward retrogression of the forest, partly in consequence of man's action, partly through the natural extension of peat or heath on the forest fringe (pp. 128–131). The authors show no disposition to exaggerate the cogency of the evidence for their thesis, and state in conclusion that the purpose of their paper is "mainly to draw the attention of local archæologists and geographers to the importance of recording any evidences in custom or right or monument of the valley-ward movement, and to ask those who study records to collect mentions of forest clearings and of pastoral migrations and other related matters" (p. 139). At the end there is a bibliography containing forty-seven entries.

G. G. C.

ASIA.

Java: Past and Present.— Donald Maclaine Campbell, late British Vice-Consul of that Island. 2 vols. London: William Heinemann. 1915. *Map and Illustrations.* 36*s. net.*

The author of these handsome volumes was a gentleman with twenty-three years' experience of Java, an island which in his opinion is "the most important in the world, and the nearest to an earthly Paradise"; yet so few people, he laments, know anything about its history or even its position on the globe, that he devoted his leisure hours to the compilation of this history "with the special object of supplying a long-felt want among my countrymen in Java and Sumatra."

It is greatly to be regretted that the author's untimely death while the book was still in the press denied him the gratification of seeing it published, and deprived it of his personal supervision, under which it would doubtless have been considerably rearranged, modified, and corrected in many points.

The opening chapters of the book—one could wish they had been read by a competent anthropologist—deal with its most ancient history. The author holds that "there are numerous reasons for supposing that at one time Java was not only connected with Asia, but also with South America;" that "the resemblances of its old Hindu ruins with those of Peru, Yucatan and Central America show a link," emphasized by its flora, "that has still to be cleared up;" that "the celebrated fossil *Pithecanthropus erectus* may well be, if not 'the commencement of humanity,' in any case the progenitor of the original inhabitants of Java . . . who may have been autochthonous." "From the autochthonous race . . . may have been descended the people of Java known as *Kalangs*," who died out in the sixteenth or seventeenth century. These "were of course negritos," "their powers of reason not far from those of the anthropoid ape." "This stock must have been Caucasian;" "bullet-headed, with square faces, heavy jaws and frizzled-woolly hair;" stone implement users, ignorant of agriculture, having no settled home. This original stock, "modified by Egyptian, Hindu, Kling, Tartar, Arabian and Chinese, constitute the present inhabitants." That they "are derived from the descendants of Japheth is evident; . . . they fulfil . . . the declaration in Genesis: God shall enlarge Japheth." (!) The author then discusses successively the Hindu and Hindu-Javanese Periods, the first European visitors, and the Dutch Period from 1610 to 1811. "It is a thing for which all Christians," remarks the author, "must for ever be thankful that the Portuguese were ousted by the more humane, conciliatory, level-headed, well-balanced and intelligent Dutchman." This reads strangely beside the account a few pages later of the fiendish tortures inflicted by these same humane Dutch upon members of the English Factory at Amboina. "Can we blame them," asks Mr. Campbell, "if they made things unpleasant for their competitors?" This they did so effectually that they held unbroken supremacy in the archipelago for two hundred years, during which, to their great credit, they raised Java especially to an extraordinary degree of prosperity. The French war at the beginning of the nineteenth century brought the Dutch Possessions in the Indies (since they had passed to Napoleon with his annexation of Holland) within the area of conflict, with the result that after a sanguinary contest Java was added to the English dominions in 1811, with Sir Stamford Raffles as the Lieutenant-Governor under Lord Minto. Raffles' biography is fully recorded in easily accessible volumes, so that it was scarcely necessary for the author to weight his work

with thirty-seven pages of a 'Life of Sir T. S. Raffles,' or with the succeeding chapter on the British occupation of the island compiled of nearly verbatim excerpts from the Memoir by Lady Raffles and from the statesman's own 'History of Java'—which throughout the volume is laid under pretty liberal contribution. The affection in which Raffles was held by Europeans and natives alike, as our author recalls, both in Java and in Bencoolen (the English Possession in Sumatra), has been corroborated by the present writer in his 'Wanderings,' where he narrates how he was accosted in 1881, fifty-seven years after Raffles' departure from Sumatra, by descendants of several of his old Bencoolen officials, who came long distances to pay their respects to Raffles' countryman. The rendition of the great Malayan islands was one of the deepest disappointments of Raffles' life. The present writer was assured by a near relative of Lord Minto that the Governor-General's despatches telling of the nature and extraordinary value of the islands and endorsing Raffles' urgent advice against the rendition were discovered—too late—pigeon-holed in Downing Street, with their seals unbroken. A sort of Gazetteer of towns concludes volume 1. More than one hundred pages of this chapter are lavishly sacrificed to verbatim extracts from tracts and documents, which are to a large extent irrelevant to the history. The reader's patience is tried, for instance, by fifteen pages of inscriptions from gravestones in Batavia, Bencoolen, Samarang, and elsewhere of quite unimportant or altogether unknown persons. The second volume opens with "Accounts of Java by Travellers, 1529 to 1832," largely copied verbatim from various published narratives. The succeeding six chapters describe the antiquities, fruits, flora, fauna, minerals, and industries of Java. Of the archæological treasures of the island an excellent account is given of the wonderfully arresting Hindu remains, illustrated by most beautiful photographs. The chapters on the flora and fauna are sadly defective, and should have been submitted to a competent biologist. When discussing the minerals and industries of Java the author is more at home, and supplies much valuable information.

We regret to have to speak of the book, though containing a vast amount of interesting information, as on the whole disappointing. Hundreds of pages are wasted on verbatim transcriptions of irrelevant and uninteresting material. Had these been omitted, and much other matter condensed, the work could have been reduced by half and its value correspondingly increased. No praise, however, is warm enough for the excellence and value of the illustrations; the landscapes are very characteristic, and give an excellent idea of the beauty of the country; the portraits of the people have a distinct ethnological value, and the photographs of the crafts are of great ethnographical interest. We should, however, have welcomed some more detailed description of the pictures than the *History* affords, especially of the curious dwarfs found at the court of Jokjokarta, of whom extremely little is known.

H. O. F.

POLAR REGIONS.

The Voyages of the "Morning."— Captain Gerald S. Doorly, R.N.R. London: Smith, Elder & Co. 1916. Size 8 × 5. Pp. xx. + 224. *Illustrations and Map.* 6*s. net.*

Captain Doorly has written a light and pleasant narrative of the two voyages of the *Morning* as relief ship to the *Discovery*. His attitude is purely personal, and the central theme is not Antarctic exploration but the companionship of Commander Evans. Doorly and Evans were cadets together on the *Worcester*, and left that ship in the same year, the former as gold medallist, the latter with

a nomination to the Royal Navy. The ambition of the two was to be together on the same ship, and this was attained when they were both appointed as junior officers on the *Morning* under Captain Colbeck in 1902. There is a delightful account of the genial way in which Sir Clements Markham helped the two friends to gratify their wish to sail together, and his fatherly care for the expedition is shown in a very pleasing light. Sir Clements had read the manuscript of the book and was about to write a preface at the time of his death, and we much regret the absence of this, though the book speaks for itself and should be very popular with all lovers of adventure. It is a sailor's story of the fine old type with real people as heroes, and is simply an ideal book for a school prize. Its more serious value as throwing sidelights on the National Antarctic Expedition is not to be overlooked, and it adds a few extra touches to the character of Captain Scott which are welcome. The illustrations are original and interesting, but we miss a map of the first voyage of the *Morning*, the track of which might very well have been shown beside that of the second.

H. R. M.

MATHEMATICAL GEOGRAPHY.

The Military Map. Elements of Modern Topography (French School of War).— G. M. London: Macmillan & Co. Pp. xi. and 130. *Price 2s. 6d. net.*

This book is a remarkable example of what happens when two authors set out to write on a subject of which they have no first-hand knowledge. It consists of an introduction by Dr. Robert Lachlan, which, in the words of the Preface, "throws fresh light on the initial process of map-making," and five chapters by G. M. professedly based on three French text-books of Topography.

The author of the introduction is a mathematician who has presumed on his knowledge of geometry to imagine for himself the way in which survey is conducted. It is evident that he has no acquaintance with the subject; but it is extraordinary that his imagination should have led him so far astray. His fundamental mistake is to speak (p. 15) as if the theodolite measures the actual angles of the plane triangle formed by three stations, and as if it is necessary to observe also the vertical angles of each ray and calculate the reduction to the horizontal plane. Had he ever used a theodolite he would have appreciated the admirable provision of nature which makes it easy to adjust the instrument to the vertical and impossible to set it in the plane of the triangle; and he might have arrived for himself at the beautiful principle of actual triangulation, that if you reduce the base to sea-level to start with, and measure the angles of your triangulation projected by the instrument itself on the horizontal plane at each station, your whole triangulation is automatically reduced to sea-level. As it is, his "fresh light on the initial process" is not illuminating.

Neither can we commend his treatment of Map Projections. He finds six with which the soldier should be familiar, two "generally used for topographical maps, that is, maps of relatively small areas, suitable for the use of an army operating in the field;" and four "which have been employed in the construction of military maps of countries like France, Germany, and Russia." The two are "The rectangular co-ordinates map"—otherwise Cassini's Projection—and the "Central Map," or the Zenithal Equidistant. Of the first he says that it is not usual to insert the meridians or parallels of latitude, "which would be curves and not straight lines or circular arcs"; and of the second that it is closely related to the Stereographic Map, which has been little used "except for maps of the polar regions, because in practice it is troublesome to draw the meridians and parallels." So much for what a soldier should know

of maps for an army in the field. For military maps of France, Germany, and Russia, thus curiously separated from the first category, our author deals with the Simple Conical Map, actually used only by Denmark; Bonne's Modified Conical Map, in which the meridians "are not simple curves but have to be plotted"; the Polyconic, in which "if the map is on a large scale the graticules are practically rectangles"; and the International Map, of which the account is not so misleading. Of the new French 1 : 50,000 alone are we told that the ellipticity of the Earth is taken into account. We learn finally that "for a series in which the maps are intended to fit together, the system generally used has been a modification of the conical map"—a statement which is a little triumph of ineptitude.

Leaving the imaginative mathematician we come to the anonymous author of the book's major part, whose trouble is that he takes for the Elements of Modern Topography text-book principles that were already discarded in the French 1 : 80,000 map with which alone he illustrates his theme, and which is itself far from modern. Consider his treatment of contours. What we call the vertical interval he calls the "natural equidistance," which multiplied by the representative fraction of the map is the "graphic equidistance." To the latter, he asserts, "a constant value has been given for all scales, which is usually fixed at a quarter of a millimetre," and the advantage of a constant value is that on all scales the distance between consecutive contours is the same for the same slope; nay more, one may immediately discover the scale of a map from the figuring of the contours!

Now it is a commonplace of topography that all this desirable theory is vitiated by the hard fact that the reciprocals of a useful set of round numbers are not themselves equally round. Map-makers have inevitably chosen simple representative fractions and simple vertical intervals; and the constant "graphic equidistance" has no real existence in topography. It is therefore worse than futile to expound it in a book intended for beginners.

Or consider the treatment of hachures. After a full description of these lines as orthogonal to the contours, ending exactly at the contours, and spaced by the *loi du quart*, we learn a little later that in fact on the French 1 : 80,000 this law is not followed, nor can one reconstitute the contours of this map by joining the feet of each rank of hachures. "Nevertheless students of topography in France are expected to be able to enlarge any given portion of the Staff Map on the scale of 1 : 80,000 into a contoured map on the scale of 1 : 40,000." They will not, however, derive assistance from our author, for at this point he changes the subject.

The terminology is largely French, in spite of the Preface, where "No apology is offered for the retention of a few French terms. . . . But when an appropriate English equivalent could be found it has always been used." We have *cote* for the figure of a contour; *crouche* for spur; *mamelon* for knoll; we have *le nivellement* defined as the *representation* of the relief, as opposed to *la planimétrie*. Among the definitions we have—

> *Cirques* are vast and deep circular depressions. Their sides are generally steep, and only a rather narrow opening admits the water from the hills.
>
> Planes, which only present a slight undulation and are generally near the sea, occupy the lowest parts of the valleys.
>
> Hills . . . are cultivated on top, and seldom exceed 300 metres in height.

And as a useful rule we have "It is usual to make the length of the scale about two-thirds of the greatest distance one will need to measure. If this is

8 cm. the length of the scale will be between 5 and 6 cm." Mark well the word 'between.'

In all the book there is no discussion of the conventional signs, nor of the lettering, nor of the use of colour; no description of other maps than the black French 1 : 80,000; no discussion of what may be done on various scales; nor any valuable remarks on the use of maps in the field. Yet this is a book with 'Modern Topography' in its title, written and published when all are in arms and working enthusiastically to fit themselves for the fight. It is therefore necessary to say that any soldier who reads it without knowing enough to enjoy it will acquire a mass of incorrect or irrelevant or perverse information which will be useless in his profession.

A. R. H.

THE MONTHLY RECORD.

THE SOCIETY.

The President honoured by the University of Oxford.

THE University of Oxford has conferred the degree of D.C.L. *honoris causâ* upon the President of the Society. In presenting Mr. Freshfield in the Congregation of June 29 the Public Orator in the following words made graceful reference to his travels, his books, and his zeal for geographical education.

> Insignissime Vice Cancellarie, vosque egregii Procuratores—Florent apud nos studia geographica, et inter eas artes quas curriculum nostrum complectitur locum sibi jampridem vindicaverunt: quo magis eum honorari oportet qui id genus notitiæ cui nos favemus quantum potuit discentibus proclivius reddidit. Hic autem quem videtis quod ipso nomine profitetur re assecutus est, ut novum aliquem campum viatoribus offerre videatur: magnam enim vitæ suæ partem visendis quæ antea fama tantum noveramus et litteris quæ viderat mandando dedidit. Adeo ut Alpes et propiora prætermittam (quæ tamen nullo modo prætermitti debent) Caucasi, Armeniæ, Imai remotas regiones juvenis adiit: quid? ne nuper quidem, si modo secreta Lunæ montium (sive potius Ruwenzori vocari malunt) exploraret, frigora et calores et itinerum duritiam reformidavit. Itaque illius societatis, quæ nova et incognita visere cupientium et incepta adjuvat et reperta ordine disponit, primum præmiis donatus mox præses electus est: quem honorem ad hunc diem obtinuit. Ceterum cum montes potissimum semper dilexerit, neque ullius scientiæ partis quæ ad montes pertineat non sit peritissimus, Alpinæ quoque illi sodalitati, quam ego maximi honoris causa nomino—etenim omnes montium amantes ad hanc velut ad arcem et sacrarium communium studiorum respiciunt—per tres annos præsedit. Neque eum ad vos duco qui non ea humanitate et eo artium liberalium studio, quo nos præcipue gaudemus, sit imbutus: cujus scripta, sicut decet primum Etonæ mox apud nos educatum, non modo

utilitatem verum etiam dulcedinem et Veneres habent: immo, qui tot montium jugis victor institit, ne Helicona quidem et Parnassum non ascendit. Præsento igitur vobis virum et vita et ingenio nobis maxime commendatum Douglas Freshfield e Collegio Universitatis, Artium Magistrum, Regiæ Societatis Geographicæ Præsidem, ut admittatur ad gradum Doctoris in Jure Civili honoris causa.

Sir Ernest Shackleton honoured by the Paris Académie des Sciences.

The Secretary has had the pleasure to receive from Monsieur Charles Lallemand, Membre de l'Institut, the following letter:—

J'ai le plaisir de vous apprendre que . . . l'Académie des Sciences, dans sa séance d'hier, a attribué à votre éminent compatriote, Sir Ernest Shackleton, l'une des récompenses dont elle dispose pour honorer les hommes qui ont rendu le plus de services à la Science. Nous avons tous été heureux de pouvoir témoigner, de cette manière, notre haute estime pour les magnifiques contributions apportées à la Géographie du globe par les explorateurs anglais, d'une manière générale, et par Sir Ernest Shackleton, en particulier. Le prix qui lui a été decerné est le prix Delalande-Guerineau; il sera officiellement proclamé dans la séance publique annuelle de l'Académie des Sciences, au mois de Décembre prochain.

EUROPE.

The Gulf Stream and Sea-level in North-West Europe.

It has been established by observations within recent years that an annual periodicity exists in the fluctuations of water-level, temperature, and salinity of the North Sea and Baltic and other waters of North-West Europe, all those elements showing a minimum in spring and a maximum in autumn. No general agreement as to the cause of the periodicity has yet been reached, though it is almost certain that the effect is due to wind action of some sort. An attempt to gain a clearer insight into the precise relation of cause and effect in this matter has been made by Mr. P. H. Gallé, who discusses the subject in a paper communicated to the Amsterdam Academy of Sciences (*Proceedings*, vol. 17, p. 1147). The observations of Breitfuss in the region of the North Cape current led Mr. Gallé to suppose the effect to be due to fluctuations in the intensity of the Gulf Stream, and he therefore endeavoured to correlate the two phenomena from the material available, taking as a basis for the Gulf Stream fluctuations those of the North-east Trade, the influence of which on the North Equatorial current is beyond doubt. His main conclusions are that: (1) Monthly fluctuations in the velocity of the North Equatorial current are responsible for monthly fluctuations of the water-level in the North Sea and Baltic; (2) the two groups of fluctuations show a phase difference of two or three months (the changes of water-level in the north naturally lagging behind those of the velocity of the current); (3) that the North Atlantic current is a direct offshoot of the Gulf Stream, and is the connection between the Gulf Stream proper and the North Sea, the Baltic, the Norwegian and the Barents Seas. It has become the fashion with some writers of late to deny all connection between the Gulf Stream and the waters that bathe our coasts, so that the above conclusions, if substantiated, will be of much interest. The

writer finds also, as was but natural, that some part of the water-raising effect is due to local winds in the region of the North Sea.

AFRICA.

The Udi Coalfield, Nigeria.

It will be remembered that one of the most important discoveries resulting from the mineral survey of Southern Nigeria carried out under the auspices of the Imperial Institute was the discovery by Mr. Kitson, during the season of 1908–09, of seams of black bituminous coal which gave promise of considerable commercial value (see 'Report on the Results of the Mineral Survey, 1908-09,' and subsequent years, by Prof. W. R. Dunstan). On the discovery, somewhat later, of the excellent port in the delta of the Niger to which the name Port Harcourt has been given, it was decided to make this the starting-point for a railway to the Udi coalfields, where mining operations were instituted under Government auspices (*Journal*, vol. 42, p. 398). The Imperial Institute now reports that such progress has already been made that ten thousand tons of the coal have been mined and are ready for use. On the completion of the "Nigerian Eastern" Railway, probably during the present year, transport can begin at once, and the coal will be at the service of the whole of Nigeria. The quality of the coal is good—much better in fact than that of many varieties already being mined in various parts of the world—and after exhaustive trials the officials of the Nigerian railways have reported upon it very favourably as a locomotive fuel. The total area of the Udi deposits is estimated as over 2000 square miles, and the seams are in places 5 feet thick.

AMERICA.

Ground-ice in Alaska.

More or less permanent masses of ice are often found buried beneath the mud and peat of the tundras of the far north, and are sometimes spoken of as fossil ice. They have been thought to prove that the climate was formerly still colder than at present, though this has been disputed (cf. *Journal*, vol. 26, p. 558). While the ice has generally been spoken of as occurring in *sheets*, the arctic explorer Mr. Leffingwell, who discusses the subject in the *Journal of Geology* (Chicago), vol. 23, No. 7, thinks that this is not usually the case in Alaska, his own experience from several years' study being that the typical form is that of vertical wedge-shaped masses. The impression of an underground ice-sheet may be given by the casual inspection of a cliff or river-bank in which ice appears at intervals, and is thought to be masked elsewhere by the slumping of the surface soil due to thaw. Mr. Leffingwell has found that in such cases the ice-masses are really isolated and of the wedge-form above spoken of. He regards the ice as of recent formation, in fissures due to frost, which divide the surface of the ground into polygonal blocks. "In the spring these frost-cracks become filled with surface water which immediately freezes. In the expansion of the frozen ground, as its temperature rises in summer, the vein of ice being more rigid than the country formation, the readjustment takes place in the latter. The result is to bulge up the enclosed block either bodily or else locally along the sides of the ice." In successive seasons a continually growing wedge of ground-ice is formed, and the tundra becomes underlain by a network of such wedges, covered over by a surface layer of mud, turf, and moss. It may be of interest to compare the phenomenon thus described with the *Polygonenboden* of German writers as observed in Spitsbergen and elsewhere, for though the details are different, and the individual polygons are far smaller in the latter case, both are ascribed to the changes in volume due to

the alternate freezing and thawing of the ground and the enclosed water. In Spitsbergen the polygons are bounded, not by ice, but by piles of rock fragments in some cases, or the absence of such fragments in others. As explained by Prof. Penck in the *Zeitschrift* of the Berlin Geographical Society (in which this and allied phenomena were discussed by various observers in 1912), the cracks would be formed by contraction *during the summer thaw*, the expansion by which the stones would be forced out of the matrix of fine silt being due to the renewed freezing. Mr. Leffingwell must surely have taken account of the expansion of water on freezing, for his explanation appears to be based on careful and prolonged observation, both in summer and winter. The features described are fully illustrated by sketches and photographs.

Recent Activity of Lassen Peak, California.

The recrudescence of activity, in 1914, of this old volcano at the southern end of the Cascade range attracted much attention as probably the first recorded instance of undoubted volcanic activity within the United States proper (*Journal*, vol. 44, p. 505). The eruption of that year was succeeded just a year later (19 and 22 May 1915) by much more violent eruptions, which devastated a considerable area, though fortunately, owing to the sparse population, no lives were lost. An interesting sketch of the whole volcanic history of the peak is given in *Science* for 26 May 1916 by Dr. J. S. Diller, whose report on the region issued by the U.S. Geological Survey in 1894 has long been the standard authority on the subject. The first upbuilding of the peak took place near the close of the Eocene period, lava-flows becoming more intense during the Miocene and Pliocene, and decreasing to near extinction in Quaternary and modern times. Both explosive and effusive eruptions have been common throughout, forming on the one hand cinder cones and sheets of agglomerate and tuff, on the other lava-fields with a great variety of constituents. Four separate craters have been formed in succession at different localities, the building up of the peak to its present height being associated with the second, while the third was formed only a few centuries ago at the north-west base of the mountain. The fourth is the new crater, the formation of which began with a slight explosion within the second, and which increased in size with each successive eruption until it reached the solid rock of the old crater rim and attained a diameter of something like 1000 feet. As on previous occasions, the eruptive phase was followed by one of effusion of lava, which filled both the new and the old crater and, after for a time forming a lid to the volcano, overflowed through a notch in the old rim. During the chief eruption the material was hot enough to be luminous. When the lid was at last forced up the superheated gases escaped, causing a hot blast which spread devastation for a distance of 10 miles along Lost Creek, trees 3 feet in diameter being broken off or uprooted. No connection can be traced between the times and dates of the individual eruptions and the supply of surface water to form steam. Dr. Diller points out the exceptional field for study offered by the volcano and its neighbourhood, which "affords one of the most alluring and attractive spots for a national park."

The Panama Canal Landslides.

The present position as regards the landslides in the Panama Canal, and the question of controlling them in future, is clearly summed up in the preliminary report of the Committee of the National Academy of Sciences (*Proceedings*, vol. 2, No. 4, 15 April 1916) appointed last November at the request of President Wilson to consider the matter in all its bearings. The majority

of the members spent two weeks in the canal zone during the winter, collecting information and examining the ground, and the report is the result of their studies. The worst slides, it will be remembered, by which all traffic on the canal was at last entirely blocked in the latter part of 1915, occurred within a limited space in the cut near Culebra, now known officially as the Gaillard cut. They were three in number—the East and West Culebra slides, just opposite each other, and the Cucaracha slide, a little further south on the east side. Their dominant importance as compared with the minor slides that have occurred in other parts is shown by the fact that they are accountable for nine-tenths of all the material removed or to be removed as a result of the yielding of the slopes. This is due both to the fact that by far the deepest part of the cut is in this district, and to the great development here of the weakest of the geological formations—the Cucaracha. This is a stratified series of softish material, much of it of a slippery, clayey, nature, and so unconsolidated as to be unable to sustain any considerable load. The prominent hills on either side of the canal are composed of massive rocks—hard intrusive basalts and tuff—and though some portions have cracked and broken away with the withdrawal of the support of the adjacent material, there is every reason to trust to their general solidity, though like the stratified material they are cut by numerous faults, which are a certain cause of weakness. The influence of earthquakes may be dismissed as quite ineffective to start or increase the slides. On the other hand, the excessive amount of water due to the heavy tropical rainfall is a serious cause of weakness, the clays being nearly saturated the greater part of the year. Although some sliding material will continue to enter the canal for several years, and must of course be removed, the Committee believes that no great extension of the slides is possible because the soft rock is mostly quite limited in extent, and more or less surrounded by the harder rocks. Even where the soft formation continues, as it does east of the East Culebra slide, future slides will be less dangerous as the water-parting has been reached and the ground slopes away from the canal. Remedial measures must consist in a control of ground and rain water, and in the unloading of certain areas so far as feasible.

AUSTRALASIA AND OCEANIC ISLANDS.

South Georgia.

Attention has been called to this isolated mountainous island in the Southern Ocean by Sir Ernest Shackleton's bold feat of crossing it on foot for the first time in search of aid for his companions during the perilous retreat from the Weddell Sea. This lends special interest to the description of its physical features given by Mr. D. Ferguson in the *Transactions of the Royal Society of Edinburgh* (vol. 50, Part 4). It is accompanied by a series of excellent photographs, on the basis of which Prof. J. W. Gregory gives a sketch of the physiography of the island, Mr. Ferguson's chief attention being given to the geological structure. Unlike most oceanic islands, such as those of the North Atlantic, South Georgia is not of volcanic origin, but represents the emergence of a folded mountain range, thought by some to be a continuation of the Patagonian Cordilleras. Its coast is entirely rock-bound, giving it a rugged and picturesque appearance, recalling parts of the north-west highlands of Scotland. The central or Allardyce range rises in Mount Paget to 8383 feet above sea-level. On the north-east side there are bare escarpments of red-brown rocks contrasting finely on a clear day with the sparkling white of the ice-fields, which occupy most of the ground above 2000 feet and the hollows of the

lower country. The south-west side, more exposed to the influences of the Antarctic continent, is one vast sheet of ice. Prof. Gregory sums up the physiography thus: "Mr. Ferguson's photographs represent South Georgia as a glaciated mountain land composed of ancient folded rocks, in which the folds have no relation to the existing topography,* as the country has been planed down to a peneplane. It is obviously part of a much larger land. In modern times subsidence has drowned the northern coast, and the effects of recent uplifts [in the form of rocky platforms and toe-like projections] show that the area is probably still in a state of oscillation." The evidences for the existence of the peneplain may not strike every one as entirely convincing; in fact in his first reference to the subject Prof. Gregory is somewhat more cautious in his language. In sending the reprint of the paper Mr. Ferguson calls attention to the map in which Sir E. Shackleton's route across the island can be followed, and says: "To one who has been in all the bays and inlets of South Georgia, and seen their wild and ice-bound character on the polar side of the island, the dauntless courage of these brave men is especially evident." On a more recent expedition he has been over the South Shetlands and parts of Graham Land. The whaler on which he returned (in February 1913) steamed round Elephant Island (where Sir Ernest's men are marooned) and others in its neighbourhood, but her master thought it too risky to land, volcanic ridges running out from it and ending in concealed shallows. There are rocky escarpments on the coast.

POLAR REGIONS.

Measures for the Relief of Shackleton's Men.

As mentioned in the July number (p. 70) the Uruguayan steam trawler *Instituto Pesca* left the Falklands on June 17 with Sir E. Shackleton on board bound for the South Shetlands, in the hope of rescuing the twenty-two men of Sir Ernest's expedition left there in a perilous position. This attempt unfortunately failed, the heavy pack-ice encountered some 20 miles from Elephant Island making further progress impossible for a steel-built vessel. The *Instituto Pesca* returned in a slightly damaged condition, but the Uruguayan Government is reported to be repairing her and to contemplate a further attempt to relieve the party. Sir E. Shackleton was landed at Punta Arenas in Magellan Strait, and there, thanks to the generosity of British residents, was able to fit out a small wooden sailing vessel with auxiliary power—the *Emma*—of eighty tons net capacity, and in her once more set out for Elephant Island on July 11. Meanwhile the Admiralty committee in this country has continued its efforts to organize more substantial succour, and has secured the use of Captain Scott's old vessel, the *Discovery*, which has generously been placed at its disposal by her present owners, the Hudson Bay Co.; it having been first ascertained that the *Aurora* (the auxiliary ship of Shackleton's original expedition, and the only suitable vessel now in the southern hemisphere) could not be got ready without considerable delay. The *Discovery* has been under repair, but was due to leave the dockyard about the middle of July, and the Hudson Bay Co. is assisting in every possible way to get the vessel ready. She will be under the command of Lieut.-Commander Fairweather, R.N.V.R., who has had considerable ice-experience in the Arctic with the Dundee whaling fleet. In view of the precarious position of the men on Elephant Island, it is to be hoped that Sir E. Shackleton may be able to reach it in the *Emma*,

* Yet it appears from Mr. Ferguson's description that the strike of the rocks corresponds with the direction of the island, and of its main range.

though it is to be feared that the prospect of his doing so is not very hopeful. Still, under certain weather conditions it is possible that the pack-ice may be temporarily cleared away even in mid-winter, and in this case he should succeed.

GENERAL.

Vacation Course in Geography at Oxford.

The eighth biennial vacation course in connection with the School of Geography at Oxford will be held this year between the 3rd and 18th of August. The opening address, on the evening of August 3, will be given by Dr. Keltie on "The Progress of Geography in the last half-century and its present position." The various branches of the subject will be dealt with by competent lecturers, and classes will be held bo a for elementary and advanced students. Excursions to places of geographical interest near Oxford will also be arranged.

Erratum in June Number.—In the review of Golder's 'Russian Expansion on the Pacific,' p. 470, six lines from end, the date should be 1673.

OBITUARY.

Henry Fanshawe Tozer.

By the death at Oxford on June 2 of the Rev. Henry Fanshawe Tozer at the great age of eighty-seven classical geography and travel lost one of its oldest and foremost representatives in this country.

Born at Plymouth in 1829, the son of Admiral Tozer, R.N., he went to Winchester in 1842, and matriculated at University College, Oxford, in 1847, where he became a pupil of Dean Stanley. He subsequently gained a Fellowship at Exeter, with which college he remained connected to the end of his life as an Honorary Fellow. His experiences in travel began with a visit to Italy, Sicily, and Greece, but were shortly extended to the wilder byways of the Balkan Peninsula, and ultimately to the recesses of Asia Minor. In the course of his many journeys he climbed many of the peaks about the Ægæan Sea. His chief ascent was that of Mount Argæus, the highest summit in Asia Minor, of which he gave a full and interesting description in the *Alpine Journal* (vol. 9).

Tozer's principal geographical works were 'The Highlands of Turkey,' 1869, 'Lectures on the Geography of Greece,' 1873, 'Primer of Classical Geography,' 1877, 'Turkish Armenia and Eastern Asia Minor,' 1881, 'The Islands of the Ægæan,' 1890, 'History of Ancient Geography,' 1897. He also edited Wordsworth's 'Greece' and Finlay's 'History of Greece.' Tozer was a Fellow of the British Academy and a member of the Alpine Club.

For the following personal sketch and appreciation we are indebted to one of Mr. Tozer's younger Oxford friends:—

Many residents in Oxford must during the last thirty years have known by sight if not by name a little man in strict clerical dress who walked briskly round the parks and their neighbourhood in all weathers. Yet his name was well known to many who did not recognize the man, for those who thirty or forty years ago enjoyed the advantages and disadvantages of a classical education must have often heard the name Tozer quoted by schoolmasters and tutors of what was then regarded as a progressive tendency. Mr. Tozer had his friends till the end; but the friendships of his later days must have seemed but faint reproductions of those which he had formed in the early and later middle age of his Oxford life. Crowther, the Bursar of Corpus, that *viator indefessus* who, as is recorded on his monument in his old college, "after

that he had travelled through the whole wide world, passed to his heavenly fatherland," had died more than twenty years before. With him Tozer had made long and adventurous journeys in that land of Albania which has been perforce a *terra incognita* to this and the last generation. His old friend, that exquisite and kindly scholar, Mr. Albert Watson, at one time Principal of Brasenose, had died in 1904. Such losses must have borne hardly on him. Yet he was always ready to help those of the younger generation who were trying in some limited way to follow in his footsteps as explorers of classical lands.

In some of the notices which have appeared since his death writers have spoken of him as the first of the English travellers who sought to throw light on classical literature. These seem to have forgotten his great predecessor Leake. Those who know the works of both men cannot but be led to compare their methods. In classical geography Tozer was an illustrator rather than a narrator. Leake was both; but then he was able to bring a scientific training to bear on the problems of classical literature. It would be out of place to use the death of Tozer as an occasion for a panegyric on Leake; but there can be no question that the latter's work is more valuable to the student of the classics. It is in literary form that Tozer's work is superior to Leake's, and perhaps for this reason it is better known to modern classical students. Yet those who know some of the lands in which Tozer travelled cannot but feel that he often missed the most magnificent opportunities of doing work which would have been a lasting possession for all lovers of classical literature. Yet he aimed in a wider sense at interpreting this literature in the light of the scenes in which its author had lived and moved; and the men of the generation in which he travelled sought not, and perhaps did not desire, too close an inspection of the "origin" of the works which they sincerely loved. Thus to the present generation, taught to look for reality rather than idealism in history, the work of such an inquirer as Tozer seems superficial. We are apt to forget that we are separated from his period of classical criticism by another of brief and sinister energy, when, under German influence, armchair critics sought to destroy our faith in the truthfulness of authors by *à priori* reasonings on matters which could only be scientifically investigated *à posteriori*. The exploration of classical lands in recent years is not due to any reaction against the seeming superficiality of such work as Tozer's, but against the unsound methods of this age of criticism which succeeded his. Had Tozer been called on to face the vaporous imaginings of this school of writers he would, no doubt, have adopted a different method of work, and have used to the full the glorious opportunities which he made for himself. As it is, it is probable that his books on historical subjects, such as his edition of Finlay's "Greece," and his work on 'The Church and the Eastern Empire,' will live longer in the world of literature which is read than his works on the geography of classical lands.

But whatever the shortcomings of his works may be from the modern point of view, they are not the defects of error. He was an accurate observer of all that interested him; and those interests carried him in the classical world of his day to a higher knowledge of the realities of the old world than any save his predecessor Leake had till then attained.

G. B. G.

Commander H. L. L. Pennell, R.N.

Harry L. L. Pennell, son of Lieut.-Colonel Reginald Pennell, was born in 1882 and educated at Exeter School. He joined H.M.S. *Britannia* in 1898,

and in the following year went to sea as midshipman, becoming a sub-lieutenant in 1902 and lieutenant in 1903.

When Captain Scott's last expedition was organized in 1910 Lieut. Pennell was appointed to command the *Terra Nova*, a position of difficulty and responsibility in which he showed the highest qualities of seamanship, and won the affection alike of his leader and his comrades. He was in command of the *Terra Nova* for exactly three years, making three consecutive voyages from New Zealand to Ross Sea.

After leaving Captain Scott at Cape Evans in January 1911 Pennell took the *Terra Nova* eastward along the Barrier to King Edward Land with the intention of landing a party there. To the amazement of all on board, the *Fram* was found in the Bay of Whales, and after the historic meeting with Amundsen the *Terra Nova* returned to Cape Evans to acquaint Captain Scott with the fateful news of the Norwegian expedition. The ship then set out in the middle of February for Cape Adare, where the Northern party under Lieut. Campbell was landed. Pennell proceeded, with instructions to push as far to the west as his coal permitted, and on February 22 he discovered and named Oates Land, being the first navigator to sight land westward from Cape North. With this discovery to his credit he returned to New Zealand, reaching Lyttelton on April 1.

During the winter the *Terra Nova* carried out three months' surveying round the Three Kings Islands in the extreme north of New Zealand—a laborious interlude touched on very lightly in Commander Pennell's too brief chapter in 'Scott's Last Expedition.' The *Terra Nova* set out for the Antarctic on 15 December 1911, making a quick voyage to Cape Adare, when the Northern party were picked up and landed again farther south on the coast of Victoria Land. On 5 February 1912 the ship reached Ross Island, where stores were landed and Dr. Griffith Taylor's party was picked up. After vain attempts to penetrate the pack along the coast of Victoria Land to take off the northern party Pennell was obliged to return to New Zealand, as the season was so far advanced as to threaten the ship with besetment. He passed closer to the Balleny Islands than any other expedition since 1839, but bad weather prevented surveying. The winter in New Zealand was spent in harbour so far as the ship was concerned; but Pennell and his companions put in several months of hard and useful work in detailed surveys of part of Cook's Strait near French Pass, working in motor-boats. He started on the third voyage on 14 December 1912, and this time, after securing a fine series of soundings southward from Lyttelton, entered the Ross Sea about on the meridian of 166° W., farther east than any expedition since the second voyage of the *Erebus* and *Terror* in 1842. Very severe ice-conditions protracted the voyage, and it was January 18 before Cape Evans was reached. The melancholy return journey to New Zealand with the news of the disaster to Scott's party completed Pennell's Antarctic service; but he remained in charge of the *Terra Nova* until he brought her into Cardiff on 4 June 1913.

On his return he was promoted to the rank of Commander, and undertook the preparation of the material relating to his own work in the expedition. He worked out the magnetic observations which had been made on the *Terra Nova*, and prepared charts of the various parts of the Antarctic which the ship visited. He also prepared several reports on special aspects of this work, and took steps to obtain a full and technical description of the *Terra Nova* for publication in the account of the expedition. His work, so far as he had carried it, was handed to the Publication Committee in a complete form when

he joined his ship in the summer of 1914, and it is deeply to be regretted that his ready help and advice will no longer be available when the publication of the results of the British Antarctic (*Terra Nova*) Expedition can be resumed.

In the summer of 1914 Commander Pennell was appointed to the battle-cruiser *Queen Mary*. After nearly two years of war service he went down with his ship in the battle of Jutland on 31 May 1916.

General Gallieni.

Like so many successful soldiers, the late General Gallieni, one of France's most trusted leaders in the present great crisis in her history, first made his mark in a sphere which offered important opportunities for the furtherance of geographical knowledge—opportunities of which he fully availed himself. In the early days of the French advance from the old colony of Senegal towards the coveted but little-known regions of the western Sudan, Captain Gallieni (as he then was) took charge of an expedition from St. Louis to the Upper Niger for purposes of exploration and the extension of French influence in those parts. During a long connection with French West Africa he did much excellent work in these directions, work that was recognized so early as 1883 by the award of one of the medals of the Paris Geographical Society. Afterwards transferred to Madagascar he did work of a high order as an administrator, and during his tenure of office as governor warmly supported all efforts for the increase of knowledge of the great island. In 1908 he published an excellent account of his work under the title 'Neuf ans à Madagascar.' In the critical days of August 1914 he was appointed military governor of Paris, subsequently taking the portfolio of Minister for War.

General Sir Albert Houtum-Schindler, K.C.I.E.

We regret to record the death of Sir Albert Houtum-Schindler, known to a limited circle of Oriental students as one of the best modern authorities on Persia, its people and literature, to which country the whole of his active career was devoted. He had been a Fellow of this Society for twenty-five years, and had contributed occasionally to its *Journal*, besides being responsible for one of its Extra Publications entitled 'Eastern Persian Irak,' published in 1896. Born in Holland in 1846, he completed his education at Leipzig University, and took up engineering as a profession. Going out to Persia he became inspector of telegraphs in that country, and subsequently undertook the reorganization of the Persian army, receiving from the Shah the rank of General and other honours, including the Order of the Sun of the First Class. After leaving the Persian service he lived a more or less retired life in this country, first near Wimbledon, latterly at Fenstanton in Huntingdonshire, where he died on June 15 last.

Sir William Wallace, K.C.M.G.

In Sir William Wallace, whose death at the age of sixty took place early in July, the country has lost an able and zealous Colonial administrator, and the Society a Fellow of nearly thirty years' standing. The whole of his public services had been given to Nigeria, where he obtained an appointment under the predecessor of the Royal Niger Company before reaching the age of twenty. He rapidly rose to positions of responsibility, and in 1886 became a senior executive officer of the Niger Company. When the Company's territories were taken over by the Imperial Government in 1900 he accepted service

under the latter, and became Deputy High Commissioner and Senior Resident in Northern Nigeria, frequently taking sole charge of the administration during the absence of the High Commissioner. He retired in 1911. Few Nigerian officials possessed a more intimate knowledge of the country and its people than Sir William, who during his long connection therewith had travelled over the length and breadth of the territory. In the early days of the Niger Company he visited Sokoto and concluded an important treaty with the Sultan, also taking part in many of the operations by which British influence was established throughout Nigeria. He contributed two excellent papers to the *Journal*, and in 1905 received the Murchison Grant in recognition of his great services to exploration and geography during his official career in Nigeria. He was made K.C.M.G. in 1907.

CORRESPONDENCE.

Kūt-el-Amāra.

THE origin, pronunciation, and meaning of the name Kūt-el-Amāra, which has now taken its place permanently in British history and chivalric record, has for some time past been the subject of discussion among those who can pretend to some knowledge of Oriental geography and speech. Amongst the uninitiated the name has suffered strange vicissitudes. Some one—"unspeakable," but certainly not a Turk—permeated by that spirit which can evolve cīnĕmă out of kīnēma, introduced to the journalistic world the form "Cŭt-ĕl-Ămără" and perpetrated, on the strength of it, the pun "cut and come again."

This subject was revived, the other day, in dinner-table talk by three persons of distinction in Eastern affairs, and nothing would convince one of them that "Cŭt-el-Ămără" was not correct; and he further insisted that "Muhammera" was akin to it. I pointed out that Mr. Percival Landon, when he lectured before the Central Asian Society, pronounced it "Kūt-el-Amāra," and informed me specifically that, to the best of his knowledge, that pronunciation was correct. I added that the principle on which the Arabic language was built up did not suggest any affinity between "Amara" and "Muhammera," or "Muhamra," as it is now often spelt in books and maps. He was not convinced.

Finally, I suggested that the point should be referred to professorial authority, and it has been. I cannot venture to reproduce the entire professorial response, but it commenced thus: "You are quite right about the pronunciation of Kût-al-Amâra (Kût like 'coot'), but the origin of the word is doubtful and I have heard no very satisfactory explanation." My correspondent, who most kindly went thoroughly into the question, showed that in authorities of Arabic, Persian, and Turkish origin, the spelling قوط العمارة and كوت العمارة were both known, and he stated that "Koweit" (كويت) is the diminutive of the first word of the name. If that be so, then the spelling should be كوت, and it is thus written in modern Turkish maps.

To further pursue my inquiry I visited an Egyptian curio-dealer, who has travelled in Turkey, Persia, Afghanistan, China, etc., and asked his opinion. He spelt it كوت ال امارا, pronounced it "Kyut" (*u* as in French), and said that كوت meant "valley," and كوت ال امارا "the valley of the building." This seems to indicate confusion in his mind between the Arabic roots امر

and عمر, and, indeed, I came to the conclusion that Oriental scholarship was not his forte.

Chesney (Euphrates Expedition) in his map, I notice, calls the place of which we are treating "Kut-el-amra, *or* el Imareh." The index to Stieler's Atlas gives nine names compounded with "Amar" or "Amara," all in countries where Islam and Arabic have long been the predominating influences. Arabic scholars generally agree that "Amāra" is an Arabic word formed from one or other of the triliteral roots, امر or عمر, the first being familiarly known to all the world in the title "Amir" or "Emir," and the second signifying "habitation." "Amāra," then, is of Arabic origin. The origin of "Kut" is less certain. I am assured by a perfectly competent Oriental linguist that it means *a fort*, and that Kaweit, the important railway terminus on the Persian Gulf, which we have safeguarded from Teutonic or Turkish intrigue, is the diminutive of it. This favours كوت as against قوط. The 'Nouveau Dictionnaire de Geographie Universelle,' by St. Martin and Rousselet (*Paris*, 1887), mentions "Al-Kout," on the Euphrates, in the province of Basra, and I find in Andree's Hand-Atlas (1914) the names Kut-el-Hai and Kut-Kleiban, the former on the Shatt-el-Hai, and the latter on the Shatt-el-Arab. I also find in the same hand-atlas, on the banks of the Karun River, three places compounded with "Kut." Stieler's Atlas, in its index, gives twelve names so compounded, all, as in the case of Amāra, situate in countries dominated by Islam and Arabic. It is still possible that Kut may be a local word adopted by the Arabs at the time of their conquests. Some affinity with the word "Kot," so familiar in India, or with "Got," the Sindhi name for a village, may suggest itself. A business man who spent some twenty or twenty-five years of his life on the Tigris and Karun Rivers informed me that "Kut," according to his experience, meant a place of permanent habitation, generally walled and capable of defence, as opposed to the movable settlements of the nomad Arabs. "Walled village" and "Fort" are practically synonymous.

Kūt-el-Amara, associated with the name of General Townshend and with the memory of some thousands of British subjects who fought, endured, and died there, thereby becoming a heritage of British pride and glory, will remain with us for all time, and may even become British territory.

A. C. YATE (Lieut.-Colonel)

P.S.—I should add that some competent Arabic scholars associate كوت with كُوَّت (pronounced *Kuwwat*), a word which is interpreted as "a niche in the wall," or "a narrow passage." This at once seems to associate the meaning with the river; it has yet to be shown that "Kut" is always applied to a place situate on the bank of a river.

Gravity Deflections in the Andes.

In reference to Colonel C. F. Close's note on "Gravity Deflections in the Andes," it may be of interest to point out that the analogy with the Himalayas is even closer than is indicated in the diagram on p. 466 if certain local peculiarities of geological structure are taken into account. The most conspicuous discrepancy is in the region represented by the stations of Mussooree and Dehra Dun in the Himalayas, and of point 44 in the Andes; but this point is a critical one in the Himalayan section, where the deflections due to the attraction of the range are largely modified by local conditions not repeated in the Andes. The station of Mussooree is situated on the older rocks of the

Himalayas proper, while Dehra Dun is on upper Tertiary rocks of the Siwalik area ; the boundary between these two rock systems lies about halfway between the two stations, and takes the form of a nearly vertical fault of somewhere between 7000 and 15,000 feet throw. Northwards of this fault the older rocks having an average density of about 2·7, extended across the range ; southwards lie the Siwalik rocks of an average density of 2·2, continued still further south by the Gangetic alluvium, having an even smaller density. The contact of two rock masses of so great a difference in density cannot but have a considerable effect on the plumb-line, and some while ago I calculated that this effect must be of the order of 16″ in the meridian at both Mussooree and Dehra Dun, which is just about the actual difference between the deflections at these stations and at point 44 in the Andes.

The high deflection at Marte is probably due to a similar cause, for it is known that north and east of the Andes there is a broad expanse of alluvium having a width of 200 miles. The form of the trough in which this alluvium lies has not been worked out in the same extent as that of the Gangetic alluvium, but he indications are that the deepest part of the trough lies towards the mountains, and that the depth shallows gradually towards the further margin ; this is very similar to the form of the trough of the Gangetic alluvium, and the dimension of the range, as well as the width of the alluvium, being much the same in both cases, it is not unnatural to expect that the depth of the alluvium is also much the same. The depth of the Gangetic alluvium near the edge of the hills is believed on good grounds to be somewhere about 15,000 feet, and seeing that a trough of 10,000 feet depth at one side, shallowing regularly to nothing in a width of 100 miles, would give rise to a deflection of 20″ at the boundary of the trough, it is easy to see that a large proportion of the 24″ observed at Marte may be due to this cause.

In the Himalayas no observations for deflection of the plumb-line have been made at stations further in from the edge of the range than Lambatach, but I may note that, according to a detailed investigation of the interrelation of the geodetic and geological observations, which I have recently completed and which is now being published by the Geological Survey of India, it is probable that the high northerly deflection found at Lambatach, and at other similarly situated stations, would disappear when the region corresponding to Poto in the Andes is reached.

It appears, then, that the analogy between the Andes and the Himalayas is much closer even than is suggested by the comparative sections. This, however, is not in itself remarkable ; the similarity in the cross-section of the two ranges would naturally lead one to expect that the effect on the plumb-line would be the same in both cases ; but the real interest in the resemblance lies in the fact that, according to Major H. L. Crosthwait's calculation, the deflection observed at Lambatach is about half as large again as it should be, when the effect of the attraction of the visible range and of its compensation are allowed for. The deflections noticed at other stations in the interior of the range show that much the same must be true of them also, but this excess of deflection has almost disappeared at stations near the edge of the hills if allowance is made for the effect of the lesser density of the alluvium.

The cause of this excess of deflection is unknown, but it is interesting to find that the peculiarity in the same direction appears to be repeated, and to about the same degree, in the similar range of the Andes.

R. D. OLDHAM.

MEETINGS: ROYAL GEOGRAPHICAL SOCIETY: SESSION 1915–1916.

Fourteenth Evening Meeting, 19 June 1916.—The President in the Chair.

ELECTIONS: Mrs. Mabel Arbuthnot; Brigadier-General William Sefton Brancker, R.F.C.; Henry Pitman Church; Captain G. V. O. Irwin; Lieut. Julian Lawrence Hamilton Smith; John Travers Tindal; Captain H. E. Weekes.

PAPER: The Gold Coast: Some Considerations of its Structure, People, and Natural History. A. O. Kitson.

Eighth Afternoon Meeting, 15 June 1916.—The President in the Chair.

PAPER: The Physical Conditions of the Weddell Sea. R. C. Mossman.

GEOGRAPHICAL LITERATURE: ADDITIONS TO THE LIBRARY. Edward Heawood, Librarian, R.G.S.

For list of abbreviations see January number.

EUROPE.

Adriatic—Marine Biology. **Brunelli.**

R. Comitato Talassogr. Ital., Mem. **43** (1914): pp. 8.

Associazione batipelagica oceanica nell' Adriatico. (Presenza della *Cyclocthone microdon* e della *Cyclothone signata*.) Per Gustavo Brunelli.

Balkan Peninsula. **Gordon.**

A woman in the Balkans. By Mrs. Will Gordon. London: Hutchinson & Co., 1916. Size 9 × 5½, pp. xvi. and 298. *Map and Illustrations. Price 12s. 6d. net. Presented.*

Bulgaria—Economic. *G.Z.* **22** (1916): 21–28. **Dix.**

Bulgarien in wirtschafts- und verkehrsgeographischer Betrachtung. Von Arthur Dix.

Eastern Europe—Political. *Contemporary Rev.* **109** (1916): 369–377. **Sands.**

The Ukrainians (Ruthenians) and the war. By Bedwin Sands. *Sketch-map.*

Serbia. **Seton-Watson.**

The Spirit of the Serb. By R. Seton-Watson. [Reprinted from 'The Spirit of the Allied Nations,' edited by Sidney Low.] London, [1915]. Size 8½ × 5½, pp. 31. *Price 3d. net.*

United Kingdom—Clyde. *Min. P.I. Civil Engin.* **200** (1915): 101–175. **Mason.**

The improvement of the River Clyde and harbour of Glasgow, 1873–1914. By Sir T. Mason. *Illustrations.*

United Kingdom—England—Thames. **Salter.**

Salter's guide to the Thames, and to the rivers Avon, Severn, and Wye, and the principal canals. By J. H. Salter and J. A. Salter. 17th editn., revised. London: Simpkin, Marshall & Co., [1914]. Size 7½ × 5, pp. 188. *Maps and Illustrations. Price 1s. net.*

United Kingdom—Old Channels. *Geol. Mag.* Dec. VI. **3** (1916): 77–81. **Kendall.**

Glacier lake channels. By Percy Fry Kendall. *Illustration.*

A reply to Prof. Bonney's paper (cf. *Journal*, January 1916, p. 72).

United Kingdom—Scotland—Geology. **Bremner.**

T. Edinburgh Geol. S. **10** (1916): 334–347.

Problems in the glacial geology of North-East Scotland, and some fresh facts bearing on them. By Alexander Bremner. *Sketch-map.*

United Kingdom—Scotland—Haddingtonshire. **Day.**

T. Edinburgh Geol. S. **10** (1916): 249–260.

The Cheese Bay Sill, Gullane. By T. Cuthbert Day. *Illustrations and Map.*

United Kingdom—Thames. *Geol. Mag.*, Dec. VI. 3 (1916): 57–64, 111–117. **Deeley.**
The Fluvio-glacial gravels of the Thames Valley. By R. M. Deeley. *Map.*

Western Europe—Ethnology. *Petermanns M.* 61 (1915): 462–464. **Tuckermann.**
Sprach- und Kulturgrenzen im Rhein- und Maasland und in Belgien. Von Walther Tuckermann.

ASIA.

China and Tibet—River valleys. *Geol. Mag.* Dec. vi. 3 (1916): 209–219. **Ward.**
Further notes on the land of deep corrosions. By F. Kingdon Ward.

India. ——
Annual Report of the Board of Scientific Advice for India for the year 1914–15. Calcutta, 1916. Size 10 × 7, pp. 191. *Price* 1*s.* 6*d.*

India—Historical. **Rawlinson.**
Intercourse between India and the Western World from the earliest times to the fall of Rome. By H. G. Rawlinson. Cambridge: University Press, 1916. Size 9 × 5½, pp. vi. and 196. *Map and Illustrations. Price* 7*s.* 6*d. net. Presented.*

India—Kashmir, etc. **Enriquez**
The Realm of the Gods; A tale of travel in Kangra, Mandi, Kulu, Chamba, Kishtwar, Kashmir, Ladakh, and Baltistan. By Captain C. M. Enriquez. London: W. Thacker & Co., 1915. Size 7½ × 5, pp. 224. *Map and Illustrations. Price* 7*s. net. Presented.*

Russian Central Asia. **Graham.**
Through Russian Central Asia. By Stephen Graham. London: Cassell & Co., 1916. Size 9½ × 6½, pp. xii. and 280. *Map and Illustrations. Price* 16*s. net. Presented.*

Western Asia—Travel. **Fowle.**
Travels in the Middle East. Being impressions by the way in Turkish Arabia, Syria and Persia. By Captain T. C. Fowle. London: Smith, Elder & Co., 1916. Size 8½ × 5, pp. xii. and 282. *Map and Illustrations. Price* 7*s.* 6*d. net. Presented.*

AFRICA.

Angola—Colonization. **Pereira do Nascimento.**
B.S.G. Lisboa 33 Sér. (1915): 253–273; 351–356.
La colonisation du plateau sud d'Angola. Par J. Pereira do Nascimento.

British East Africa—Mount Kenya. **Orde-Browne.**
J. African S. 15 (1916): 225–233.
Mount Kenya and its people. Some notes on the Chuka tribe. By G. St. J. Orde-Browne.

Egypt—Economic. **Dudgeon.**
Ministry of Agriculture, Egypt. Egyptian Agricultural Products. *Sorghum vulgare*, the Great Millet; also *Sorghum halepense*. By Gerald C. Dudgeon. Cairo, 1915. Size 10 × 7½, pp. 32. *Price P.T.* 3.

Egypt—Economic. **Dudgeon.**
Ministry of Agriculture, Egypt. Egyptian Agricultural Products. *Arachis hypogæa*, the Ground Nut, or Earth Pea. By Gerald C. Dudgeon. Cairo, 1916. Size 10 × 7½, pp. 24. *Price P.T.*2.

Sierra Leone—Anthropology. **Thomas.**
Anthropological report on Sierra Leone. By Northcote W. Thomas. Part I. Law and Custom of the Timne and other tribes (pp. 196). Part II. Timne-English dictionary (pp. 140). Part III. Timne grammar and stories (pp. 86). London: Harrison & Sons, 1916. Size 8½ × 5½. *Sketch-map and Illustrations. Presented.*

Sierra Leone—Languages. **Thomas.**
Specimens of languages from Sierra Leone. By Northcote W. Thomas. London: Harrison & Sons, 1916. Size 11 × 7½, pp. 62. *Presented.*

NORTH AMERICA.

North America—Early travel. **Mereness.**
Travels in the American Colonies. Edited under the auspices of the National Society of the Colonial Dames of America by Newton D. Mereness. New York:

The Macmillan Comp., 1916. Size 9 × 5½, pp. vi. and 694. *Price* 12*s.* 6*d. net. Presented.*

United States—Potash. *J. Franklin I.* 180 (1915): 641–651. **Cameron.**

Possible sources of potash in America. By Frank K. Cameron.

United States – Railway. **Partsch.**

Memorial Vol. transcont. Excurs. Amer. G.S. (1915): 201–221.

Die Nordpazifische Bahn: die geographischen Bedingungen ihres Werdens und Wirkens. By Joseph Partsch. *Illustrations.*

United States—San Francisco. **Rühl.**

Memorial Vol. transcont. Excurs. Amer. G.S. (1915): 287–311.

San Francisco. By Alfred Rühl. *Maps and Illustrations.*

United States—Sierra Nevada. **Machatschek.**

Memorial Vol. transcont. Excurs. Amer. G.S. (1915): 313–327.

Ein Profil durch die Sierra Nevada, mit einen Vergleich mit der Schollenstruktur in Zentralasien. By Fritz Machatschek. *Illustrations.*

United States—Virginia. **Sams.**

The conquest of Virginia. The forest primeval. By Conway Whittle Sams. London: Putnam's Sons, 1916. Size 9½ × 6, pp. xxiv. and 432. *Maps and Illustrations. Price* 18*s. net. Presented.*

United States—Wisconsin. **Whitbeck.**

Wisconsin Geol. and Nat. Hist. Surv., B. 42 (1915): pp. 105.

The geography of the Fox-Winnebago Valley. By Ray Hughes Whitbeck. *Maps and Illustrations.*

CENTRAL AND SOUTH AMERICA.

Central America—Archæology. **Joyce.**

Central American and West Indian archæology, being an introduction to the archæology of the states of Nicaragua, Costa Rica, Panama, and the West Indies. By Thomas A. Joyce. London: P. Lee Warner, 1916. Size 9 × 5½, pp. xvi. and 270. *Maps and Illustrations. Price* 12*s.* 6*d. net. Presented.*

West Indies—Jamaica—Handbook. **Ford and Cundall.**

The handbook of Jamaica for 1916. By Joseph C. Ford and Frank Cundall. Thirty-sixth year of publication. Kingston, 1916. Size 9 × 5½, pp. viii. and 642. *Maps. Presented.*

AUSTRALASIA AND PACIFIC ISLANDS.

Australia—Fauna. *P.R.S. Victoria*, N.S. 28 (1915): 139–148. **Sloane.**

On the faunal subregions of Australia. By Thomas G. Sloane.

Australia—Economic. **Taylor.**

Meteorology of Australia. Commonwealth Bureau of Meteorology, Melbourne. The climatic control of Australian production. (An attempt to gauge the potential wealth of the Commonwealth.) By Griffith Taylor. *Bulletin* No. 11. N.P., N.D. Size 12 × 10, pp. 32. *Maps.*

Australia—Hydrology. **Pittman.**

Department of Mines. Geological Survey of New South Wales. The composition and porosity of the intake beds of the great Australian artesian basin. By E. F. Pittman. Sydney, 1915. Size 9½ × 7½, pp. 15. *Illustrations.*

Hawaii—Legends. **Westervelt.**

Legends of Old Honolulu. Collected and translated from the Hawaiian. By W. D. Westervelt. London: Constable & Co., 1915. Size 7½ × 5, pp. x. and 282. *Sketch-map and Illustration. Price* 6*s. net. Presented.*

New Zealand—Year-book. **Fraser.**

The New Zealand Official Year-book, 1915 (twenty-fourth year of issue). . . . By Malcolm Fraser. Wellington, N.Z., 1915. Size 8½ × 5½, pp. xii. and 1004. *Sketch-maps and Diagrams. Presented.*

Queensland—York Peninsula. **Jack.**

The exploration of Cape York Peninsula, 1606–1915. By Dr. Robert Logan Jack. (From *The Australian Hist. Soc.*, vol. 3, Part V., 1915.) Sydney, 1915. Size 8 × 5, pp. 181–226. *Sketch-map. Presented.*

MATHEMATICAL GEOGRAPHY.

Cartography. **Drew.**

Aids to the use of maps employed by the English, French, Belgian, and German Armies. By Thos. Drew. London: Jarrold & Sons, [1916]. Size 6½ × 4. *Diagrams. Price* 1*s. net.*

Cartography.

The Military Map. Elements of modern topography. (French School of War.) London: Macmillan & Co., 1916. Size 8½ × 6½, pp. vi. and 130. *Maps and Diagrams. Price* 2*s.* 6*d. net. Presented.*

See review in the present number, p. 168.

Orientation. **White.**

Steering by the stars for night-flying, night-marching, and night boat-work between latitudes 40° N. and 60° N. By James Dundas White. London: J. D. Potter, [1916]. Size 6½ × 4, pp. 32. *Diagrams. Presented.*

Cf. paper by Mr. Reeves on "Night-marching by Stars," June *Journal*, p. 446.

Surveying. **Cary**

Geodetic Surveying. By Edward R. Cary. First edit. New York: J. Wiley & Sons, 1916. Size 8 × 5, pp. x. and 280. *Illustrations and Diagrams. Price* 10*s.* 6*d. net. Presented.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Geology—Ice Age. *B. Geol. I. Univ. Upsala* **13**, i. (1915): 35–44. **Enquist.**

Eine Theorie für die Ursache der Eiszeit und die geographischen Konsequenzen derselben. Von Fredrik Enquist. *Map.*

Attributes the Ice-age to a lowering of sea-level by change in the form of the sea floor.

Geomorphology. *J. Geology* **24** (1916): 27–46. **Reinecke.**

Average regional slope, a criterion for the subdivision of old erosion surfaces. By Leopold Reinecke. *Map and Illustrations.*

The writer's views on this subject were referred to in a note on a previous paper (*Journal*, vol. 46, p. 315).

Oceanography—Sea-water. **Manuelli.**

R. Comitato Talassogr. Ital., Mem. **50** (1915): pp. 16.

Sulla solubilità del gesso nell' acqua di mare. Per Antonio Manuelli.

Phytogeography. *J. Ecology* **3** (1916): 193–210. **Brenchley and Adam.**

Recolonization of cultivated land allowed to revert to natural conditions. By Winifred E. Brenchley and Helen Adam. *Illustrations.*

River-Discharge. **Jones.**

U.S. Geol. Surv., Water-Supply Paper 375–E (1915): 117–130.

A method of correcting river discharge for a changing state. By Benjamin E. Jones. *Illustrations.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropology. **Giuffrida-Ruggeri.**

La così detta culla dell' umanità. By G. Giuffrida-Ruggeri. (Estrato dalla *Rivista Italiana di Sociologia*, Anno XIX, fasc. v.-vi.—Settembre—Decembre 1915.) Rome, 1915. Size 9½ × 6½, pp. 8.

Anthropology. *Smithsonian I., Misc. Coll.* **65** (1915): No. 12, pp. 31. **Miller.**

The jaw of the Piltdown Man. By Gerrit S. Miller. *Illustrations.*

Anthropology. *National G. Mag.* **29** (1916): 111–127. **Roosevelt.**

How old is man? By Theodore Roosevelt. *Maps and Illustrations.*

Communications—Wireless. **Wireless Press.**

The Year-book of Wireless Telegraphy and Telephony, 1916. London: The Wireless Press, [1916]. Size 8½ × 5½, pp. civ. and 876. *Map and Illustrations. Price* 3*s.* 6*d. net. Presented.*

A valuable work of reference, giving full information on the present position of wireless telegraphy throughout the world. The wireless regulations of the various states and colonies are summarized, and complete lists of land and ship stations given.

There are also general articles on recent developments of wireless, a dictionary of technical terms, biographical and bibliographical data, and so forth.

GENERAL.

Education—Text-books. **Brigham and McFarlane.**

Essentials of geography. First and second book. By Prof. Albert Perry Brigham and Dr. Charles T. McFarlane. New York: American Book Co., 1916. Size 10 × 8, pp. (Book I.) 266; (Book II.) 426. *Maps and Illustrations. Presented.*

Book I. deals with the World in a simple manner, with a fuller study in Book II.

Geography and War. *J. Manchester G.S.* **31** (1915): 12–22. **Whyman.**

The effect of geographical features on the war at sea. By T. Whyman.

Geography in Education. *G. Teacher* **8** (1916): 230–243. ——

The relations of geographical and historical teaching in schools.

Science. **Gregory.**

Discovery; or the spirit and service of Science. By R. A. Gregory. London: Macmillan & Co., 1916. Size 7½ × 5, pp. viii. and 340. *Illustrations. Price* 5*s. net. Presented.*

NEW MAPS AND PHOTOGRAPHS: ADDITIONS TO THE MAP ROOM.

E. A. Reeves, Map Curator, R.G.S.

EUROPE.

Austria—Dalmatia. **Dainelli.**

Dott. Prof. Giotto Dainelli: Carta della Dalmazia publicata sotto gli auspici della "Pro Dalmazia" alla scala di 1:500,000 (1 inch to 7·89 stat. miles). Con note esplicative. Novara: Istituto Geografico De Agostini, 1916. *Price* 2 *Lire. Presented by the Publishers.*

Shows relief in layers of green and reddish-brown superimposed upon hill shading. The contours given, at which also the tints change, are 100, 200, 300, 500, 1000, 1500, and 2000 metres. The boundaries of Venice in 1669, 1699, and 1718 are laid down, and other information specially connected with the population is also given. The map contains five insets, two of the Adriatic as a whole, and the remaining three of the environs of Cattaro, Tara, and Sebenico. There are also six pages of letterpress.

Balkan Peninsula. **Agostini.**

La Futura Balcania secondo le pretese degli Imperi Centrali (con note esplicative alla scala di 1:3,000,000 (1 inch to 47·3 stat. miles). Size 22 by 19 inches. Novara: Istituto Geografico De Agostini, 1916. *Price* 0.70 *Lira. Presented by the Publishers.*

A general map upon which the author has attempted to show the boundaries of the Balkan States after the war according to the arrangement of the Central Powers. The map is accompanied by two pages of letterpress.

Balkan Peninsula. **Kümmerly and Frey.**

Balkanländer. Scale 1:1,000,000 or 1 inch to 15·8 stat. miles. Two sheets, each 30 by 42 inches. Bern: Kümmerly & Frey, [1916].

A general wall map of the Balkan States with parts of adjacent countries to the north as far as a few miles beyond the 48th parallel of latitude. Relief is generalized and effectively shown by tints ranging from bluish-grey to reddish-yellow, on what is known now as the "spectral" system. The names of important places are in bold type, so that they can be seen at a distance, while others are in small type and can only be read by close inspection. International boundaries are in red dotted lines.

Europe. **Agostini.**

Teatro della Guerra Europea alla scala de 1:4,000,000 (1 inch to 63·13 stat. miles). Seconda editione popolare. Size 27 by 37 inches. Novara: Istituto Geografico De Agostini, 1916. *Price* 1 *Lira. Presented by the Publishers.*

A cheaply produced highly coloured map of Europe, not so legible in parts as it might be, published to illustrate events in connection with the war.

Europe. **Dardano and Magistris.**

Atlante della Nostra Guerra. 16 tavole doppie a colori e numerose illustrazioni nel testo. Tavole redatte da Achille Dardano: Testo redatto da L. F. de Magistris. Size 16 by 12 inches. Novara: Istituto Geografico De Agostini, 1916. *Price* 10 *Lire. Presented by the Publishers.*

An atlas prepared specially in connection with the Italian military operations, and consisting of sixteen double-sheet coloured maps, each measuring 13 by 20 inches, and sixty pages of text, with photographic views and small black-and-white maps. In addition to large-scale maps of Trentino and other parts of the frontier district between Italy and Austria, there are general maps of Europe, Italy, the Balkan States, maps of the other theatres of war, frontier maps, and linguistic and ethnographic maps. Some of these maps show relief by layers of brown and green, superimposed on vertical hachuring. Among other matters of interest the text contains brief historical and general accounts of the various countries concerned in the European war, with maps of the world showing their position and colonial possessions. Some of the photographic reproductions are specially good.

Europe. **Mittelbach.**

Mittelbach's Neueste Hand- und Verkehrskarte von Mittel-Europa vom Paris bis Petersburg, vom Kattegat bis Venedig mit allen Kriegsschauplätzen und mit Kennzeichnung der besetzten feindlichen Gebiete. Scale 1:1,500,000 or 1 inch to 23·6 stat. miles. Size 35 by 47 inches. Leipzig: Mittelbach's Verlage, [1916]. *Price* 1.50 *M.*

Norway. **Ræder.**

Automobil Kart over det Sydlige Norge til og med Namdalen. Utarbeidet av Kaptein N. Ræder. Scale 1:600,000 or 1 inch to 9·5 stat. miles. Two sheets, each 26 by 33 inches. Christiania: Kongelig Norsk Automobilklub, 1915. *Price* 14 *Kr.*

An outline map, showing roads of various characters in red and black symbols, specially for the use of automobilists. Railways, boundaries, and other information are given. The limits and numbers of the sheets of the 1:100,000 Government survey are given in red lines for the use of those who desire to obtain large-scale maps with more details. Relief is not indicated either by contours or shading, but there are a few spot heights, of which more might have been added without overcrowding the map.

Sweden. **Generalstabens Litografiska Austalt, Stockholm.**

Sverige i 32 Kartblad. Skala 1:500,000 (1 inch to 7·9 stat. miles). Utarbetad vid Generalstabens Litografiska Anstalt under redaktion av Överste S. Zetterstrand. Sheets: 2, Halmstad–Växjö; 3, Karlskrona–Oskarshamn; 6, Mjölby–Västervik; 7, Gottland; 10, Örebro–Stockholm; 13, Öregrund–Dalarö; 20, Örnsköldsvik–Holmsund; 21, Kolåsen–Frostviken; 22, Ström–Asele; 23, Umeå–Skellefteå; 24, Stensele–Sorele; 25, Byske–Boden; 26, Nasafjäll–Arjeplog; 27, Jokkmokk–Öv. Luleå; 28, Luleå–Haparanda; 32, Riksgränsen. Stockholm: Albert Bonniers Förlag, [1916]. *Published in parts, each part, price* 1 *Kr., containing two sheets.*

Since the publication of Selander's map of Sweden about thirty years ago no detailed map of the whole of the country on a sufficiently large scale to be of much service has appeared, and the want of such a map has been felt for a considerable time. Since that date much new survey work of various kinds has been done, so that there exists now sufficient topographical material for the production of a much more complete map than was then possible. The question of the publication of such a map was taken up by the Swedish General Staff in 1906, and subsequently several officers were employed in its compilation. In 1908 about half the sheets were drawn, and it is hoped that the whole map, in thirty-two sheets, will be published by October 1916.

The original drawings are being done on the 1:250,000 scale, and these are afterwards photolithographed on the 1:500,000 scale. Relief is shown in layers of green, buff, brown, and for heights above 2000 metres a somewhat unsatisfactory shade of purple. The tints change at every 200 metres above sea-level, but the intermediate 100-metre contours are drawn. An exception to this is the lowlands, where two shades of green are used, one for 0 to 100, and another for 100 to 200 metres. The map is not so clear as it might be, and rather overcrowded with small names. Railways, roads with their relative importance, and canals are indicated, as well as the location of minerals, boundaries, and other information. When complete it will be accompanied by a full index of place-names, any of which can be found on the map by the usual method of reference letters and numbers.

ASIA.

China. **Chinese Maritime Customs.**

Chinese Maritime Customs Chart. Published by order of the Inspector-General of Customs. China, East Coast. No. 1, North and South Channel, Entrances to the Yangtze River and their Approaches; 2, Yangtze River, sheet 1, Woosung to Plover Point, including Tsungming Crossing; 3, Yangtze River, sheet 2, Plover Point to Kiushan Point. Shanghai: Marine Department, Chinese Maritime Customs, 1915–16. *Presented by Mr. S. V. Mills, Surveyor, Chinese Maritime Customs.*

These three sheets show the course of the Yangtse from its mouth to Kiushan Point, about 75 miles above Wusung. The first, which is one-half the scale of the other two, includes the entrances and the river as far as Wusung, and the other two give the continuation of the river above this place. For the purpose of safe navigation it is necessary that surveying operations should be continually in progress, as the banks and channels are constantly changing, and the officers of the Marine Department of the Chinese Maritime Customs have this important work in hand. The present sheets are based upon their latest surveys of 1913–1915, and give much detailed information, with many lines of soundings along and crossing the river in all directions. These soundings are expressed in feet, and are reduced to the level of extraordinary spring tides. Bracketed dates which occur in various parts denote when the locality was sounded. All lights are carefully shown, and there are various diagrams as insets giving the range of the tide at different places and times. The charts, on Mercator's projection, have been prepared for publication from the field books and observations by Mr. S. V. Mills, one of the surveyors of the department. It is interesting to note that Mr. Mills states that these charts are the first of their kind ever produced solely in China, and as such they are most satisfactory and creditable.

India. **Surveyor-General of India.**

Maps published by the Survey of India during the quarter ending 31 March 1916. **General maps:** Telegraph map of India corrected to 30 September 1914, scale 1 inch to 32 inches, 6 sheets; India, showing Provinces and Districts, scale 1 inch to 160 miles, 1915. **Degree sheets,** scale 1 inch to 4 miles, sheets: Bengal and Assam, 78 P (layered and shaded, layered only, shaded only), 1914; Berar, Bombay, and Hyderabad, 46 P (layered and shaded, layered only, shaded only), 1915; Bombay and Goa, 48 E, 48 I (provisional issue), 1915; Bombay, Madras, and Mysore, 48 K (layered and shaded, layered only, shaded only), 48 N (provisional issue), 1915; Bombay, Mysore, and Goa, 48 J (provisional issue), 1915; Burma, 84 K, 84 M, 92 F (layered and shaded, layered only, shaded only), 1915; Hyderabad, 56 F, 56 G, 56 K (provisional issue), 1915–16; Hyderabad and Berar, 56 A (provisional issue), 1915; Kashmir and Jammu, 43 N (provisional issue), 1915; Madras, 57 J, 57 M, 58 G, 58 H, 58 L (provisional issue), 1915; Madras and Hyderabad, 57 I (provisional issue), 1915; Madras, Hyderabad, and Central Provinces, 65 G (provisional issue, with additions and corrections from Extra Departmental sources to 1914), 1914; Madras, Karikal, and Pondicherry, 58 M (provisional issue), 1915; Punjab, North-West Frontier Province, and Kashmir and Jammu, 43 G (layered and shaded, shaded only), 1915. **Half-inch Sheets,** scale 1 inch to 2 miles, sheets: Hyderabad, 56 E-S.W. (preliminary edition), 1915; Hyderabad and Berar, 56 A-N.E. (preliminary edition). **Standard Maps,** scale 1 inch to 1 mile, sheets: Assam, 83 B-10, 83 B-12, 83 B-15, 83 B-16, 83 F-2, 83 F-8, 1915; Bengal, 79 F-14 (preliminary edition), 1915; Bengal and Bihar and Orissa, 73 J-10 (preliminary edition), 1915; Berar, 55 D-10, 55 D-14, 1915; Berar and Central Provinces, 55 K-6, 55 K-7, 1915; Bihar and Orissa, 72 C-16, 72 D-5, 72 D-16, 72 G-4, 72 G-8, 72 G-12, 72 H-7, 72 H-8, 72 H-11, 72 H-13, 72 H-14, 72 H-15, 72 L-3, 72 H-16, 72 L-7, 73 A-14, 73 B-7, 73 E-13, 73 I-1, 73 J-1, 73 J-5, 1915; Burma, 92 D-4, 92 D-6, 92 G-3, 92 G-6, 92 G-16, 95 J-12, 95 O-1; Central Provinces, 55 J-10, 55 K-5, 55 K-9, 55 K-10, 55 K-16, 1914–15; Kashmir and Jammu, 43 F-9 and 13, 43 F-10, 43 J-5, 43 J-15, 43 N-1, 43 N-2, 43 N-7; Madras, 57 H-12, 57 L-2, 57 L-6, 57 L-7, 57 L-9, 57 L-10, 57 L-12, 57 L-14, 57 L-15, 57 L-16, 58 C-7, 58 C-10, 58 C-11, 58 C-14, 58 C-15, 58 D-10, 58 C 1 and 5, 58 G-2, 58 G-3; Madras and Mysore, 57 H-9; Punjab, 43 L-3, 44 O-14, 53 B-13, 53 E-4, 53 F-1, 53 F-2; Punjab and United Provinces, 53 F-15, 53 G-5; United Provinces, 53 F-16, 53 G-9, 53 G-11, 53 G-12, 53 J-3, 53 J-4, 62 D-16, 62 H-4, 63 A-1, 63 B-8, 63 B-9, 63 B-11, 63 E-11, 63 I-1, 63 I-3, 63 I-4, 63 I-7, 63 J-1, 63 J-5, 63 J-9, 63 J-13; United Provinces and Nepal, 62 D-15, 62 H-3, 62 H-8, 63 E-9, 63 I-6, 63 I-10, 63 I-15. Calcutta: Map Record and Issue Office, 1916. *Presented by the Surveyor-General of India.*

South-West Asia. **Bartholomew.**

Bartholomew's Map of Asia Minor, Egypt, Mesopotamia, and Persia. Scale 1 : 4,000,000 or 1 inch to 63·1 stat. miles. Size 21 by 34 inches. Edinburgh : John Bartholomew & Co, [1916]. *Price, mounted on cloth, 2s. 6d. net. Presented by the Publishers.*

This map extends from Constantinople to the Western Afghanistan frontier and from the Black Sea to the southern shores of the Persian Gulf, and so include an important area in connection with present military operations. Relief is indicated by tints of green and brown, the contour intervals at which they change being every 500 feet up to 2000 feet, after which they are 2000 to 3000, 3000 to 6000, 6000 to 10,000, 10,000 to 15,000, and above 15,000 feet. Some of the tints might with advantage have been made lighter. The map should be decidedly useful at the present time for general reference.

Turkey. **American Geographical Society, New York.**

European Spheres of Influence and Territorial Claims in Turkey. Scale 1 : 9,000,000 or 1 inch to 142 stat. miles. Size 8 by 12 inches. From the *Geographical Review*, vol. 1, No. 4, 1916. New York : The American Geographical Society, 1916. *Presented by the American Geographical Society.*

AFRICA.

Anglo-Egyptian Sudan. **Geographical Section, General Staff.**

The Anglo-Egyptian Sudan. Scale 1 : 3,000,000 or 1 inch to 47·35 stat. miles. Compiled in the Geographical Section, General Staff, from the latest editions of Sudan and other maps. Printed at the War Office, 1914. Size 35 by 26 inches. *Price 2s. 6d. net. Presented by the Director of Military Intelligence.* London Agents : E. Stanford, Ltd. ; Sifton, Praed & Co. ; T. Fisher Unwin.

East Africa Protectorate. **Geographical Section, General Staff.**

Africa. Scale 1 : 250,000 or 1 inch to 3·95 stat. miles. Sheet North A 36–W, Mumia's, East Africa Protectorate. Surveyed under the direction of the Director of Surveys, East Africa Protectorate, 1913. Drawn and printed at the War Office, 1916. Size 18 by 18 inches. *Price 1s. 6d. net. Presented by the Director of Military Intelligence.* London Agents : E. Stanford, Ltd. ; Sifton, Praed & Co. ; T. Fisher Unwin.

Morocco. **Bureau Topographique du Maroc Occidental.**

Carte du Maroc. Scale 1 : 500,000 or 1 inch to 7·89 stat. miles. Sheets : 1, Tanger–Melilla, 1914 ; 2, Rabat-Fès Taza, 1916 ; 3, Fès Oudjda, 1916 ; 4, Casablanca–Tadla-Safi, 1915 ; 5, Kasba Tabla–Bou Denib, 1915 ; 6, Bou Denib–Figuig, 1914 ; 7, Marrakech–Mogador–Agadir, 1913. Size 19 by 24 inches. Casablanca : Bureau Topographique du Maroc Occidental, 1914–16. *Presented by Mr. H. L. Rabino.*

These seven sheets together include the northern and western parts of Morocco. They have been compiled from the route surveys of French military officers and other sources of information. Nos. 2, 3, 4, and 5 are new editions.

An attempt has been made to represent the relief by layers of reddish-brown, but it is not stated what the contours are. Most of the country is so roughly mapped that these contours can be only very approximate.

Morocco. **Bureau Topographique du Maroc Occidental.**

Maroc. Carte Administrative et Militaire. Scale 1 : 1,500,000 or 1 inch to 23·6 stat. miles. Size 20 by 24 inches. Casablanca : Bureau Topographique du Maroc Occidentale, 1914. *Price 1.00 fr. Presented by Mr. H. L. Rabino.*

A black and white outline map upon which are shown in bold lines, symbols, and lettering the French administrative and military divisions, relative importance of places from administrative and military standpoints, and other information.

AMERICA.

Canada. **Dept. of the Interior, Ottawa.**

Atlas of Canada. Revised and enlarged edition. Prepared under the direction of J. E. Chalifour, Chief Geographer. Size 18 by 13 inches. Ottawa : Department of the Interior, 1915. *Presented by the Department of the Interior, Ottawa.*

The first edition of this atlas appeared in 1906 and contained a large amount of geographical and statistical information in the form of maps, plans, diagrams, and tables. In the new edition which has lately been published the whole has been thoroughly revised and brought up to date, so that it may almost be considered an

entirely new atlas. There are altogether 30 double-page maps, 8 on single sheets, 43 statistical diagrams and plans of 13 cities and towns, besides statistical tables. The subjects dealt with and set forth on the maps are many, and include land relief, geology, minerals, forests, origins of the people, density of population, telegraphs, railways, canals, lighthouses and sailing tracks, routes of explorers, boundaries, and meteorology.

The statistical diagrams are clear, and give in a graphic manner much information on the trade, population, agriculture, manufactures, fisheries, education, immigration, etc., of Canada.

The tables which precede the maps will be useful, those dealing with the population being based upon the census of 1911.

Some new maps are added, and others have been redrawn. One noticeable change is the tinting showing the general relief of the land, which, instead of being entirely in shades of brown as in the 1906 edition, is now in different colours, some of which might have been improved. The map showing routes of travellers only give a selection of some of the more important routes, and it cannot be considered at all complete.

Canada. **Dept. of Mines, Ottawa.**

Geological Survey of Canada. Map 37A, Beaverdell, Yale District, B.C. Scale 1 : 62,500 or 1·014 inch to 1 stat. mile. Size 15 by 12 inches. Ottawa : Department of Mines, Geological Survey, 1915. *Presented by the Department of Mines, Ottawa.*

Canada. **Dept. of the Interior, Ottawa.**

Sectional Map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheets : 115, Blackfoot, Alberta, 7th edit. ; 120, Qu'Appelle, Saskatchewan, 7th edit., 1916 ; 121, Riding Mountain, Manitoba, 8th edit., 1915 ; 270, Pasquia, Saskatchewan, 6th edit. ; Edmonton, Alberta, 9th edit. ; 362, Simonette, Alberta, 1st edit. ; 463, Smoky River, Alberta, 2nd edit. ; 515, Wabiskaw, Alberta, 2nd edit., 1915 ; 524, Limestone River, Manitoba, 1st edit. ; 565, Birch Hills, Alberta, 1st edit. ; 575, Port Nelson, Manitoba, 1st edit. Ottawa : Department of the Interior, Topographical Surveys Branch, 1915–16. *Presented by the Department of the Interior, Ottawa.*

Canada. **Dept. of the Interior, Ottawa.**

Standard Topographical Map of Canada. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Sheets : 3 N.W., Kingston, Ontario ; 4 N.E., Yarmouth, Nova Scotia ; 5 N.W. and 14 S.W. (part), Halifax, Nova Scotia ; 8 S.E., French River, Ontario ; 9 S.E., Pembroke, Ontario and Quebec. Size 33 by 20 inches. Ottawa : Department of the Interior, 1916. *Presented by the Department of the Interior, Ottawa.*

Canada—Alberta. **Dept. of the Interior, Ottawa.**

Northern Alberta. Scale 1 : 792,000 or 1 inch to 12·5 stat. miles. Map showing disposition of lands. Prepared in the Railway Lands Branch under the direction of F. C. C. Lynch, Superintendent. Corrected to 1 January 1916. Size 42 by 34 inches. Ottawa : Department of the Interior, Railway Lands Branch, 1916. *Presented by the Department of the Interior, Ottawa.*

United States. **Rand, McNally.**

Rand-McNally New Official Railroad Map of the United States and Southern Canada. Scale 1 : 35,258,880 or 1 inch to 83 stat. miles. Size 28 by 38. Chicago and New York : Rand, McNally & Co., 1916.

United States—California. **Rand, McNally.**

Rand-McNally Indexed Pocket Map of California. Scale 1 : 1,140,480 or 1 inch to 18 stat. miles. Size 37 by 31 inches. Chicago and New York : Rand, McNally & Co., [1916].

This is a new edition.

United States. **Fitch.**

The Rare Map of the North-west [of the United States] 1785 by John Fitch. A Bibliographical Account with facsimile reproduction, including some account of Thomas Hutchings and William McMurray. By P. Lee Phillips, Chief, Division of Maps and Charts, Library of Congress. Washington : W. H. Lowdermilk & Co., 1916.

This is a facsimile reproduction of an important map in connection with the early cartography of the United States, and the greater interest attaches to it from the fact that one object for which it was published was to raise funds for the carrying on of experiments in connection with the construction of the steamboat, the real inventor of which is admitted by many to be John Fitch, the author.

The map includes the Great Lakes, the upper course of the Mississippi, with the Ohio, Illinois, and other rivers flowing into it, and extends east as far as the Alleghany mountains. On it are many interesting notes on the character of the country and natives.

John Fitch was born in 1743, and in early days devoted his spare time to the study of surveying and geography, afterwards leading a roving life in the wild west mapping out lands which might afterwards prove to be valuable and lead to a fortune, which, however, never seems to have been realized. It was during these expeditions that this map was made from his own explorations and astronomical observations, and doubtless in many respects it was far more accurate than any previously constructed. Only very few copies are known to be in existence, and Mr. P. Lee Phillips deserves the thanks of geographers for the excellent reproduction he has published, and for the interesting notes with which the facsimile is accompanied. The original from which this facsimile is taken is in the possession of Dr. A. S. W. Rosenbach of Philadelphia.

WORLD.

World. **Davies.**

A Map of the World (on Mercator's Projection) having special reference to Forest Regions and the Geographical Distribution of Timber Trees. Prepared by J. Hudson Davies, F.R.H.S. Equatorial Scale 1 : 24,500,000 or 1 inch to 386 stat. miles. Size 30 by 40 inches. Edinburgh and London: W. & A. K. Johnston, Ltd., 1916. *Price, mounted on rollers and varnished, 6s. Presented by the Publishers.*

A map of the world on Mercator's projection showing by means of tints of yellow, brown, and green, (1) tundra and snow-covered regions, (2) direct regions, (3) grassland and prairie, (4) well-wooded regions (20 per cent. to 40 per cent. of land surface), and (5) densely wooded regions (upwards of 40 per cent. of land surface). Across these tints in bold type are given the names of the principal timber trees characteristic of the various regions. There are two small inset maps of the world on Mollweide's projection, one giving mean annual isotherms and zones of tree-growth, and the other annual rainfall. At the bottom of the map is given a diagram showing the vertical distribution of tree-growth on the principal mountains of the world, from 75° S. to 75° N. lat. A subject of this kind can only be dealt with in a very general manner on a comparatively small map of the whole world, but so far as it goes the map is interesting and instructive. It is only one of a series of five maps, and the others, since they only deal with special divisions of the Earth, will doubtless treat of the subject in more detail. It is difficult to understand why Mercator's projection was chosen for the purpose, as it is perhaps the least suitable of all for representing the distribution of any natural phenomena.

PHOTOGRAPHS.

New South Wales.

Two books containing thirty-two panoramic views of Sydney, New South Wales, taken by H. Phillips and Bacon & Co., Ltd. *Presented by Mr. S. J. Haddon.*

A set of excellent panoramic views of the principal buildings, streets, and harbour of Sydney, with places of interest in the neighbourhood. Each separate panorama is 20 inches long and 5 to 7 inches broad, and in some cases they are double, two being joined to form one long view. They are reproductions of clear photographs, and serve well to give a good idea of Sydney at the present time.

West Africa. **Bowyer-Bower.**

Enlargement of a photograph of the Tree of Sacrifice, Kumassi, Ashanti, taken by T. Bowyer-Bower in November, 1906. *Presented by Mrs. T. Bowyer-Bower.*

The tree represented in this photograph has a somewhat gruesome interest attached to it, since before the days of British rule and influence hundreds of natives were sacrificed beneath it. As shown here, it has been much damaged by lightning, and it is understood that at the present time it no longer exists. The photograph is an enlargement measuring 12 by 10 inches of a negative taken by Mr. Bowyer-Bower in 1906.

N.B.—It would greatly add to the value of the collection of Photographs which have been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

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